PROGRAM OF STUDY

Automated Systems Electromechanics (DVS 5888)

TRAINING SECTOR: ELECTROTECHNOLOGY

Votre gouvernement

Québec

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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] *Education Act*, CQLR, c. I-13.3, s. 461.

1. Behavioural Competency

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

- 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 recreate 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 characteristics:

- 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.

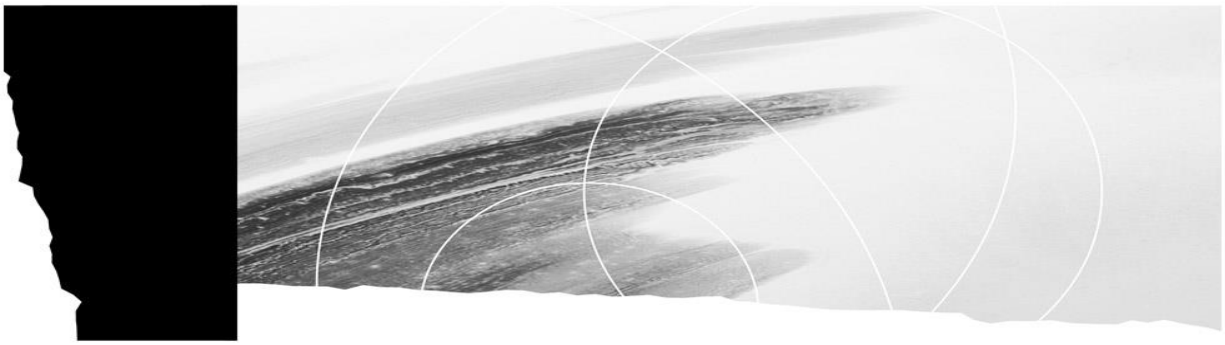
Aspects of Program Implementation

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, since it presents learning as a coherent whole.

Competency-Based Approach

In vocational training, the competency-based approach is based on 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.



5888	**Automated Systems Electromechanics**

Year of approval: 2024

Certification:	Diploma of Vocational Studies
Number of credits:	120
Number of competencies:	23
Total duration:	1800 hours

To be eligible for admission to the *Automated Systems Electromechanics* program, candidates must meet one of the following requirements:

- Persons holding a Secondary School Diploma or its recognized equivalent (e.g. Attestation of Equivalence of Secondary Studies) or a diploma of higher studies, such as a Diploma of College Studies or a bachelor's degree.

OR

- Persons who are at least 16 years of age on September 30 of the school year in which they begin their training must have obtained Secondary IV credits in language of instruction, second language and mathematics in programs 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 must have the following functional prerequisites: the successful completion of the general development test and ENG-2102-4, MTH-4151-1 and MTH-4153-2, or recognition of equivalent learning.

OR

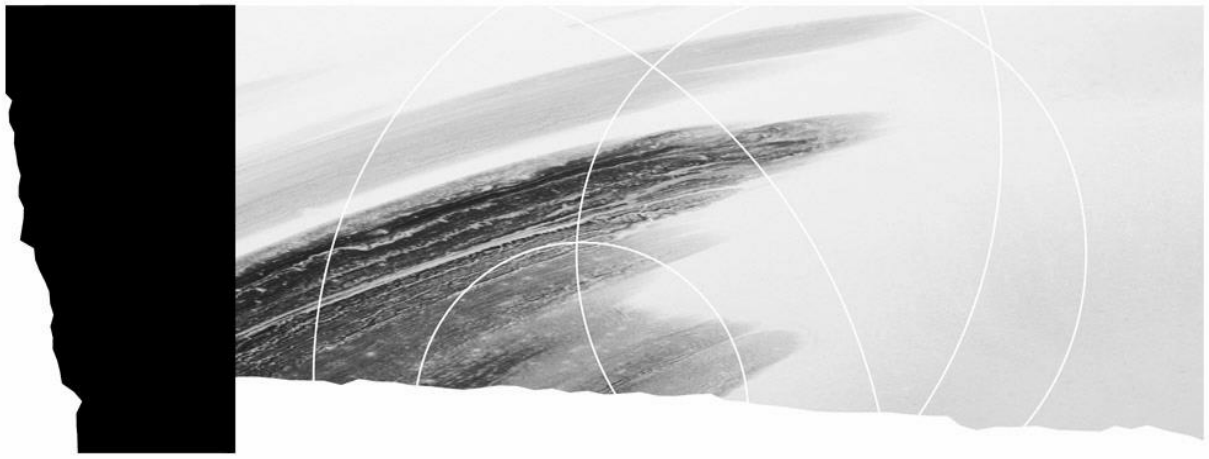
- Persons who have obtained Secondary III credits in language of instruction, second language and mathematics in programs established by the Minister are required to pursue general education courses, concurrently with their vocational training, in Secondary Cycle Two school programs established by the Minister.

The duration of the program is 1800 hours, which includes 870 hours spent on the specific competencies required to practise the trade and 930 hours on general, work-related competencies. The program of study is divided into 23 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.

Specific Features of the Program

Successful completion of some or all of the program competencies may entitle students, at their request, to certifications issued by recognized authorities.

Competency	Code	Number	Duration	Credits
The Trade and the Training Process	782901	1	15	1
Health and Safety on Construction Sites	754992	2	30	2
Troubleshooting Electrical Circuits	782928	3	120	8
Sketches	782933	4	45	3
Shopwork	782947	5	105	7
Cutting and Welding	782955	6	75	5
Access and Handling	782962	7	30	2
Preparation and Installation of Watertight Ducts	782974	8	60	4
Machine Tool Operations	782986	9	90	6
Troubleshooting Electronic Circuits	782995	10	75	5
Programming Logic Circuits	783006	11	90	6
Maintaining and Troubleshooting Mechanical Systems	783016	12	90	6
Pneumatic and Electropneumatic Circuits	783027	13	105	7
Maintaining and Troubleshooting Electric Motor Circuits	783037	14	105	7
Hydraulic and Electrohydraulic Circuits	783047	15	105	7
Electronic Motor Control Devices	783055	16	75	5
Control Loops	783065	17	75	5
Programming Automated Systems	783077	18	105	7
Planned Automated System Maintenance	783085	19	75	5
Troubleshooting Automated Systems	783097	20	105	7
Installing Automated Systems	783108	21	120	8
Career Development	783111	22	15	1
Entering the Workforce	783126	23	90	6



Part I

Program Goals

Educational Aims

Statements of the Competencies

Grid of Competencies

Harmonization

Program Goals

The *Automated Systems Electromechanics* program prepares students to practise the trade of automated systems electromechanical technician.

Electromechanical technicians install, maintain, troubleshoot, refurbish, repair, modify and make all types of industrial equipment, including production equipment, machine tools and handling equipment.

They work on automated systems that include electronic, electrical, hydraulic and pneumatic circuits, and on mechanical and robotic systems.

They work in manufacturing companies, processing plants, public utility companies, mining companies, hydroelectric power plants, etc. They can also work for contracting firms specializing in electromechanical equipment maintenance or manufacturing.

This is a trade for people who enjoy variety and challenging work. It involves stressors such as the need to adapt to new equipment and minimize interruptions in the production chain. However, these stressors tend to diminish as electromechanical technicians gain experience.

The work may sometimes require physical stamina. Electromechanical technicians may work in very different environments depending on the employment setting. They may be exposed to dust, noise and temperature swings. Their work week often exceeds 40 hours.

Electromechanical technicians often work in teams with other electromechanical technicians. They also work with production equipment operators, clients and other tradespersons, including industrial mechanics, electricians, welders, machinists and engineers.

With experience, an electromechanical technician can develop specialized skills in a particular area, such as programming and electrical troubleshooting. In that case, they may be asked to act as a resource person in that particular area, either for their team or for the entire company. People who want more responsibility may sometimes rise to positions where they manage several teams or even the entire maintenance department.

The program goals of the *Automated Systems Electromechanics* 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 or occupation, that is:
  - to teach students to perform roles, functions, tasks and activities associated with the trade or occupation upon entry into the job market
  - 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, health and safety)
- To help students integrate into the workforce, that is:
  - to familiarize students with the job market in general, and with the specific context of their chosen trade or occupation
  - 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 or occupation
  - to help students develop self-expression, creativity, initiative and entrepreneurial spirit
  - to help students adopt the attitudes required to successfully practise the trade or occupation, 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 *Automated Systems Electromechanics* program is to help students develop attitudes and behaviours that representatives from education and the field deem essential to the practice of the trade:

- self-reliance, for example to manage their time or learn on their own
- tolerance to stress, for example, during a production shutdown, or in the case of a costly or hazardous repair or tight deadlines
- the ability to work in a team

Statements of the Competencies

List of Competencies

- Determine their suitability for the trade and the training process.
- Prevent risks to health, safety and physical well-being on construction sites.
- Troubleshoot single-phase alternating current (AC) and direct current (DC) circuits.
- Draw sketches.
- Do shopwork.
- Cut and weld metals.
- Use access and handling equipment.
- Prepare and install watertight ducts.
- Perform machining operations using machine tools.
- Troubleshoot industrial electronic circuits.
- Program logic circuits.
- Maintain and troubleshoot mechanical systems.
- Install, maintain and troubleshoot pneumatic and electropneumatic circuits.
- Maintain and troubleshoot electric motor circuits.
- Install, maintain and troubleshoot hydraulic and electrohydraulic circuits.
- Install and calibrate electronic motor control devices.
- Connect and calibrate control loops.
- Program automated systems.
- Implement a planned automated system maintenance program.
- Troubleshoot automated systems.
- Install automated systems.
- Manage their career.
- Enter the workforce.

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, as well as the major steps in the work process.

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. The symbol (△) indicates a correlation between a specific competency and a step in the work process. 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

AUTOMATED SYSTEMS ELECTROMECHANICS				**GENERAL COMPETENCIES**														**PROCESSES**					**TOTAL**
SPECIFIC COMPETENCIES	**Competency number**	**Type of competency**	**Duration (in hours)**	Determine their suitability for the trade and the training process	Prevent threats to health, safety and physical well-being on construction sites	Troubleshoot single-phase alternating current (AC) and direct current (DC) circuits	Draw sketches	Do shopwork	Cut and weld metals	Use access and handling equipment	Prepare and install watertight ducts	Perform machining operations using machine tools	Troubleshoot industrial electronic circuits	Program logic circuits	Install and calibrate electronic motor control devices	Program automated systems	Manage their career	Prepare the work	Do the work	Verify the work	Record the data	Clean and tidy up the work area	
Competency number				1	2	3	4	5	6	7	8	9	10	11	16	18	22						
Type of competency				S	S	B	B	B	B	B	B	B	B	B	B	B	S						
Duration (in hours)				15	30	120	45	105	75	30	60	90	75	90	75	105	15						930
Maintain and troubleshoot mechanical systems	12	B	90	○	●		●	●	○	●		○					○	▲	▲	▲	▲	▲	
Install, maintain and troubleshoot pneumatic and electropneumatic circuits	13	B	105	○	●	●		●		○	●	○	○	○			○	▲	▲	▲	▲	▲	
Maintain and troubleshoot electric motor circuits	14	B	105	○	●	●		●		●		○	○		○		○	▲	▲	▲	▲	▲	
Install, maintain and troubleshoot hydraulic and electrohydraulic circuits	15	B	105	○	●	●		●		○	●	○	○	○		○	○	▲	▲	▲	▲	▲	
Connect and calibrate control loops	17	B	75	○	●	●				○	○		●		●	○	○	▲	▲	▲	▲	▲	
Implement a planned automated system maintenance program	19	B	75	○	●	●	○	●	○	●	●	●	●	○	●	●	○	▲	▲	▲	▲	▲	
Troubleshoot automated systems	20	B	105	○	●	●	○	○	○	○	○	○	●	●	●	●	○	▲	▲	▲	▲	▲	
Install automated systems	21	B	120	○	●	●	●	●	○	●	●	●	●	●	●	●	○	▲	▲	▲	▲	▲	
Enter the workforce	23	S	90	○	○	○	○	○	○	○	○	○	○	○	○	○	○	△	△	△	△	△	
Total duration:			870																				1800

Links between the general and specific competencies:

○: Existence of a link
●: Application of a link

Links between the work process and the specific competencies:

△: Existence of a link
▲: Application of a link

Harmonization

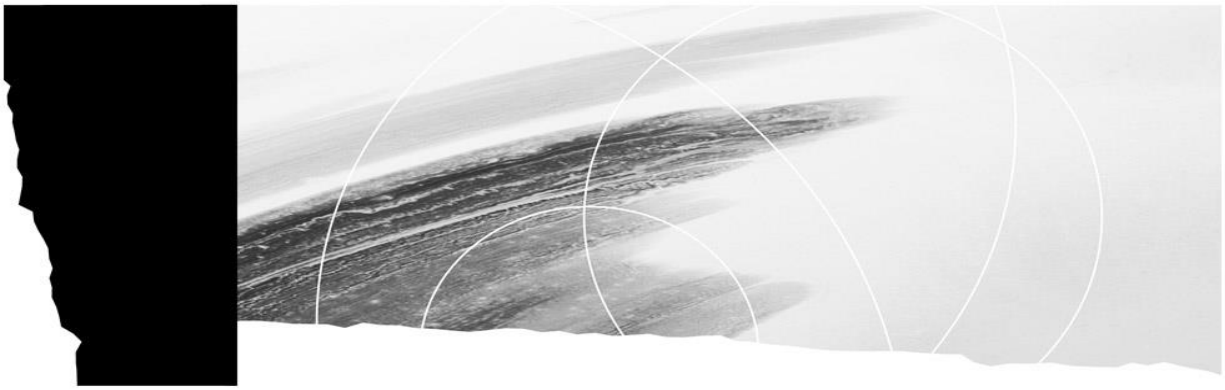
Harmonization of vocational and technical programs is a Ministerial orientation. It involves establishing similarities and continuity between secondary- and college-level programs within a particular sector or between sectors in order to avoid overlap in program offerings, to recognize prior learning 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.

Harmonization of the *Automated Systems Electromechanics* program has resulted in identifying competencies that are shared with other programs. Detailed information on the harmonization of this program and its results is presented in the document entitled *Tableaux d'harmonisation, Électromécanique de systèmes automatisés*.



Part II

Program Competencies

The Trade and the Training Process	Code: 782901

Competency 1 Duration 15 hours Credit 1

Situational Competency

Statement of the Competency

Determine their suitability for the trade and the training process.

Elements of the Competency

- Become familiar with the nature of the trade and potential career opportunities.
- Understand the training process.
- Confirm their career choice.

Learning Context

Information Phase

- Learning about the nature of the trade (e.g. legal and regulatory framework).
- Learning about the characteristics of the job market in automated systems electromechanics (workplaces, job prospects, remuneration and opportunities for advancement and transfer).
- Learning about the nature and requirements of the job (e.g. tasks, working conditions).
- Learning about the training program (program of study, training process, evaluation methods and certification of studies) and opportunities for continuing training.

Participation Phase

- Discussing the skills, attitudes and knowledge required to practise the trade.
- Discussing the relevance of the training program with respect to the trade of electromechanical technician.
- Participating in a group visit to a workplace.
- Presenting the information gathered and discussing their perception of the trade.

Synthesis Phase

- Assessing their aptitudes, preferences, skills, attitudes and aspects to be improved with regard to practising the trade.
- Assessing their career choice by comparing the requirements of the trade with their profile.

Instructional Guidelines

- Foster discussion and allow all students to express themselves.
- Help students develop a realistic perception of the trade.
- Make available all relevant technical documents.
- Organize an activity allowing students to become familiar with the workplace and talk to people who practise the trade.
- Provide students with the means to assess their career choice honestly and objectively.

Participation Criteria

Information Phase

- Gather information on most of the topics to be covered.

Participation Phase

- During a group meeting or a meeting with the teacher, and making connections with the information gathered, present their perception of:
  - the training program
  - the trade.

Synthesis Phase

- Present an oral or written report containing:
  - a summary of their preferences, interests and aptitudes
  - explanations of their career choice, explicitly comparing the requirements of the trade with their preferences, interests and aptitudes.

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

- Locating of relevant information in technical documents, during visits, at meetings or on the Web; importance of the information source.
- Note-taking method.
- Definition of the trade: tasks, functions, etc.
- Laws, regulations, codes and standards governing the work of electromechanical technicians.
- Fields of activity, hiring statistics, salaries, etc.
- Skills sought by employers.
- Conditions required for learning: favourable climate, interest, concentration, physical and mental well-being, etc.
- Code of conduct and requirements of the educational institution.
- Training process, scope of practice of the trade and versatility.
- Content of the program of study and information about evaluation for certification purposes.

Participation Phase

- Method of organizing and presenting information.
- Information to take down during a visit to a workplace or a meeting with a person who practises the trade.
- Advantages of sharing their point of view and listening to others.
- Rules governing group discussion: listening, each person’s right to speak, staying on topic, attentiveness to others, openness to different points of view, etc.
- Development of an attitude of openness to constructive criticism.

Synthesis Phase

- Definition of expectations.
- Preferences with respect to the field of application and tasks performed.
- Reasons for their career choice, their view of the trade and means of practising it, and evaluation of their situation with respect to their career path.
- Principal elements of an oral or written report confirming their career choice: summary of their preferences, interests and aptitudes, and the requirements for practising the trade; comparison of their preferences, interests and aptitudes with the requirements of the trade.
- Explanation of their career choice.

Health and Safety on Construction Sites	Code: 754992

Competency 2 Duration 30 hours Credits 2

Situational Competency

Statement of the Competency

Prevent risks to health, safety and physical well-being on construction sites.

Elements of the Competency

- Develop a responsible attitude regarding occupational health and safety risks.
- Be aware of the importance of complying with occupational health and safety laws, regulations and standards.
- Recognize dangerous situations or risky behaviours and the applicable preventive measures.

Learning Context

Information Phase

- Learning about the risks inherent in construction sites.
- Learning about the laws, regulations and standards respecting health and safety on construction sites.
- Learning the measures to take in the event of an emergency.
- Reflecting on the importance of acquiring proficiency in occupational health and safety.

Participation Phase

- Experiencing situations in which risks must be prevented and dangers eliminated with respect to the environment, facilities, machinery, equipment, materials, tools, energy sources, etc.
- Participating in activities allowing them to recognize the risks associated with moving loads and awkward work postures.
- Participating in activities allowing them to recognize symbols and signals associated with risk prevention (hazardous products, road work, transportation of hazardous materials, etc.)
- Comparing risky behaviours observed on a construction site and identifying the basic principles of safe behaviour.

Synthesis Phase

- Presenting a report containing:
  - a summary of their newly acquired knowledge and skills
  - an assessment of their attitude with respect to occupational health and safety
  - their goals and means of improvement.

Instructional Guidelines

- Provide the necessary information sources.
- If applicable, invite occupational health and safety specialists to meet with students.
- Make the best use of audiovisual materials.
- Make extensive use of learning situations that reflect the reality of construction sites.
- Prevent students from performing unsafe acts during simulations.
- Foster the participation of all students in discussions.
- Guide the students in their self-assessment by providing them with the tools needed (e.g. questionnaire) to help them analyze their experience and set their goals.

Participation Criteria

Information Phase

- Consult the information sources made available to them.
- Describe the advantages of complying with occupational health and safety laws, regulations and standards on construction sites.

Participation Phase

- Participate in the suggested activities and take them seriously.
- State the principles of safe behaviour.
- Make a list of the risks associated with 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 with respect to occupational health and safety
  - their goals and means of preserving their own health, safety and physical well-being and those of others on a construction site.

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

- Importance of information about health and safety on construction sites.
- The most common risks to health, safety and bodily security on construction sites.
- Sources of information about health and safety on construction sites and locating of the relevant information.
- Roles and responsibilities with respect to health and safety on construction sites.
- Legal framework for occupational health and safety.
- Advantages of complying with occupational health and safety rules on construction sites.
- Prevention of illness and accidents.

Participation and Synthesis Phase

- Risks inherent in the site itself and in the practice of the trade.
- Preventive measures to apply depending on the risks.
- Systems for identifying hazardous material.

Troubleshooting Electrical Circuits	Code: 782928

Competency 3 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Troubleshoot single-phase alternating current (AC) and direct current (DC) circuits.

Achievement Context

- Given:
  - production equipment with relay-controlled electrical circuits
  - verbal or written orders.
- Using:
  - personal and collective protective equipment
  - electrical circuit diagrams
  - technical documentation
  - measuring instruments and tools
  - replacement components and consumables.

Elements of the Competency	Performance Criteria
1. Analyze an equipment failure.	• Accurate interpretation of orders and diagrams. • Correct identification of the part of the circuit in question. • Plausible hypotheses as to the cause of the failure. • Accurate determination of the theoretical values at different junctions in the circuit.
2. Identify the parameters of an electrical circuit.	• Accurate location of components in the circuit. • Measurements taken at the appropriate junctions. • Accurate reading of values measured.
3. Make a diagnosis.	• Correct comparison of values measured with theoretical values. • Accurate determination of the component that caused the failure in the circuit. • Appropriate determination of the corrective measure that will solve the problem.
4. Do a repair.	• Proper removal of defective component. • Appropriate choice of replacement component. • Proper installation of replacement component. • Proper preparation and installation of wires, if applicable.

5. Ensure the proper operation of an electrical circuit.	• Thorough inspection of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of appropriate corrections, if necessary.
6. Finish the work.	• Comprehensive and accurate record of the work done. • Appropriate cleaning of work area. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments and tools.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Health and safety rules for working with electricity (review of Competency 2).
- Nature of potential electrical work: installation, maintenance, repair, modification, etc.
- Limits of the scope of practice of electromechanical technicians, and qualifications required to work with electricity.
- Safe procedure for turning power on, off and locking out an electrical circuit (lockout).
- Methods of producing and transporting energy.
- Distinction between conductors and insulators.
- Nature of electricity (movement of electrons between atoms).
- Characteristics of magnetism.
- Characteristics of electrical phenomena: electromagnetism, induction, etc.
- Structure of a building's electrical network (e.g. power source, electrical installation, apparatus) and the related equipment (e.g. main electrical panel, secondary electrical panel, disconnect).
- Types of voltage: direct current, alternating current, single phase and three phase, etc.
- Role of safety devices such as fuses, breakers, thermal overload relays, etc.
- Role and functioning of transformers, relays, switches, etc.

- Terminology related to electrical waves: amplitude, period, frequency, etc.
- Terminology related to voltage values: peak voltage, instantaneous voltage, peak to peak, root mean square (RMS).
- Definition of apparent, real and reactive power.
- Distinction between the control and power parts of an electrical circuit.
- Categories of electrical system safety.
- Colour code, types and gauges of electric wires.
- English and French terminology related to electrical circuits.
- Importance of taking note of useful information.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.

1. Analyze an equipment failure.
    - Questions to ask to gather information about the job to be done.
    - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
    - Basic English and French terminology related to industrial equipment.
    - Interpretation of an electrical circuit diagram (European and American standards).
    - Locating and interpretation in an electrical circuit diagram of the symbols representing electrical components and sources: transformers, relays, power supplies, pushbutton contacts, fuses, thermal overload relays, motors, etc.
    - Steps in a logical diagnostic method.
    - Visual inspection and interpretation of results.
    - Possible causes of electrical circuit failures.
    - Basic principles of Ohm's law: relationships between power, voltage, current and resistance.
    - Formula of Ohm's law and determining the missing variables.
    - Calculation of different parameters (power, voltage, current and resistance) for series, parallel and series-parallel alternating current and direct current circuits.
    - Effects of capacitors and inductors in alternating current and direct current circuits.

2. Identify the parameters of an electrical circuit.
    - Locating of components and sources in the circuit: transformer, relay, power supply, pushbutton contact, fuse thermal overload relay, motor, etc.
    - Locating of terminals on the components.
    - Measuring instrument safety ratings (e.g. CAT II 1000V).
    - Use of a multimeter and clamp-on ammeter: choice of operating mode, methods of connecting them, and reading of the values of the different parameters.
    - Methods of taking relevant electrical measurements.

3. Make a diagnosis.
    - Acceptable tolerances between the parameters measured and the values calculated.
    - Possible causes of defects and their impact: short circuit, open circuit and loose contact.
    - Impact of a defect on voltage, current and resistance.
    - Types of interventions that can be carried out on circuit components, and selection criteria: cleaning, repair and replacement.

4. Do a repair.
    - Characteristics and use of the main tools used in electricity: wire cutters, long-nose pliers, screwdriver, wire stripper, ferrule crimper, etc.
    - Methods of repairing conductors.
    - Criteria for choosing a replacement component.
    - Methods of cleaning electrical parts.
    - Preparation and installation of conductors: cutting, stripping, installation of ferrules, tinning, etc.
    - Importance of appropriate tightening of connecting screws.

5. Ensure the proper operation of an electrical circuit.
    - Operation of basic safety devices.
    - Importance of installing mechanical safety devices before testing.
    - Important points to verify before powering up.
    - Method of detecting short circuits.
    - Powering up procedure.
    - Production equipment start-up procedure.
    - Points to check to ensure the proper operation of the production equipment.
    - Best method for taking relevant measurements.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

6. Finish the work.
    - Data to be recorded (e.g. on a work order.
    - Description of electrical circuit components and defects: importance of using the appropriate terminology in the electrical circuit diagram or technical documentation: short circuit, open circuit, names of components, etc.
    - Characteristics of a clear and explicit summary of the work done.
    - Precautions to be taken when storing measuring instruments and tools.

Sketches	Code: 782933

Competency 4 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Draw sketches.

Achievement Context

- Given a simple mechanical component requiring three orthographic projections.
- Using:
  - the equipment needed to draw freehand and perform computer-aided drawing (CAD)
  - measuring instruments: graduated ruler, tape measure, vernier calliper, etc.
  - an email application.

Elements of the Competency	Performance Criteria
1. Take measurements of a component.	• Accurate determination of measurements to take. • Accurate determination of measuring system used. • Appropriate use of measuring instruments. • Accurate measurements.
2. Draw freehand an orthographic projection of a component.	• Proper selection of views. • Appropriate arrangement of views. • Observance of proportions. • Observance of shapes. • Use of the appropriate types of lines. • Presence of all lines.
3. Handwrite the dimensions and additional data on a sketch.	• Accuracy and arrangement of dimensions on a sketch. • Presence of all the data needed to manufacture a component. • Absence of redundancy.
4. Reproduce a component in a technical drawing application.	• Effective use of the basic functions of an application. • Faithful reproduction of a component. • Correct indication of dimensions and additional data. • Proper backing up of file.

5. Transmit a file.	• Proper printing of file, if applicable. • Appropriate transfer of file in a different format • Proper transmission of file using an email application.
	For the competency as a whole: • Clarity and legibility of the sketches. • Proper choice and appropriate use of measuring instruments and drawing equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Imperial and metric units for measuring length, and conversion from one system to the other.
- Distinction between orthographic and isometric projections.
- Steps in the production of a sketch.
- Importance of neatness, and accurate and clear indications.
- English and French terminology related to technical drawing.

1. Take measurements of a component.
   - Use of imperial and metric units of measurement.
   - Measurement and reading methods used with graduated rulers, tape measures, vernier callipers, etc., in millimetres and fractions of an inch.
   - Method of determining the measuring system used.
   - Determination of the diameter of a hole and the thread pitch.

2. Draw freehand an orthographic projection of a component.
   - Distinction among the different views in technical drawing.
   - Criteria for choosing which views to draw.
   - Convention concerning the arrangement of views.
   - Method of transferring a sketch from one view to another.
   - Methods of drawing horizontal, vertical, oblique, perpendicular and curved lines.
   - Methods of drawing geometric shapes: squares, rectangles, circles, etc.
   - Characteristics of the different types of lines: contour, hidden, centre, etc.
   - Elements to verify to ensure the compliance of a sketch.

3. Handwrite the dimensions and additional data on a sketch.
    - Convention concerning the arrangement of dimensions.
    - Convention concerning extension lines and dimensions.
    - Dimensioning of sizes and positions.
    - Dimensioning of diameters, radii and angles.
    - Dimensioning of threads and bevels.
    - Arrangement of dimensions.
    - Indication of threaded holes.
    - Method of verifying the presence of all the necessary dimensions, without redundancies.
    - Additional data: nature of the material to use, measurement system used, number of components to draw, name of drafter, tolerances, annotations, data needed to manufacture the component, etc.
    - Importance of indicating additional data.

4. Reproduce a component in a technical drawing application.
    - Terminology related to the functions of a drawing application.
    - Basic functions: locating and reading of a file, creation of a file and choice of a file name (importance of choosing a coherent and logical name), use of application commands, method of backing up a file (on a removable medium, to the cloud, etc.), etc.
    - Distinction among the different axes: x, y and z.

5. Transmit a file.
    - Selection (or addition) of a printer and adjustment of printer settings.
    - Distinction among the different paper formats.
    - Most common file format types.
    - Method of transferring files in a different format.
    - Advantages and disadvantages of the different email applications.
    - Functions of email applications: transfer a file, send to several recipients, etc.

Shopwork	Code: 782947

Competency 5 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency	**Achievement Context**
Do shopwork.	• Given verbal or written orders. • Using: – personal and collective protective equipment – technical drawings or sketches – ferrous and non-ferrous materials – tools and equipment – technical documentation.

Elements of the Competency	**Performance Criteria**
1. Cut workpieces using a hand saw and a power saw.	• Determination of the exact dimensions of the workpieces to cut. • Economical use of materials. • Proper marking out of workpieces. • Regular cutting of workpieces. • Appropriate shape and dimensions of workpieces. • Proper deburring of workpieces.
2. Drill holes using a portable drill and a drill press.	• Accurate determination of: – the position of the holes to be drilled – the dimensions of the holes to be drilled, including those that are to be tapped. • Proper marking out of workpieces. • Precise punching of hole centres. • Correct calculation and adjustment of the rotation speed of the drill bit. • Appropriate dimensions of pilot holes, if applicable. • Appropriate dimensions of holes. • Correct positioning and squareness of holes.
3. Grind workpieces using a sander, a file and a portable grinder.	• Absence of burrs or striations. • Appropriate dimensions of workpieces.
4. Tap holes and thread rods.	• Accurate determination of the diameter of rods for threading. • Uniform and continuous threads. • Alignment of threads to the axis.

5. Extract bolts.	• Drilling to the appropriate diameter. • Precise drilling at the centre of the bolts. • Proper insertion of bolt extractor. • Appropriate extraction of bolts. • Intact threads in holes.
6. Bolt components together.	• Proper assembly of fasteners. • Accurate determination of bolt torque. • Compliance with bolt torque.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Compliance with orders, drawings and sketches. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Accurate determination of sequence of operations. • Appropriate choice and use of equipment, tools, accessories and measuring instruments.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Risks associated with shopwork (review of Competency 2).
- Importance of wearing personal protective equipment (PPE): safety glasses, safety shoes, etc. (review of Competency 2).
- Properties (e.g. hardness) of the most commonly used materials.
- Technical drawing concepts: tolerance, scale, views, etc. (review of Competency 4).
- Interpretation of mechanical drawings and sketches (review of Competency 4).
- Importance of following manufacturers' recommendations concerning the use of measuring instruments, tools and equipment.
- Characteristics and use of measuring instruments, and selection criteria: graduated ruler, tape measure, vernier calliper, square, etc. (review of Competency 4)
- Conversion between values in different units of measurement and between imperial and metric units of measurement (review of Competency 4).
- Method for searching in technical documentation.
- English and French terminology related to shopwork.
- Importance of keeping the work area always organized.

Shopwork	Code: 782947

1. Cut workpieces using a hand saw and a power saw.
    - Importance of optimizing the use of materials.
    - Criteria for choosing blades: teeth, thickness, etc.
    - Installation of cutting accessories: blade, cutting disk, etc.
    - Determination of cutting speed based on the material to be cut.
    - Characteristics and use of jigsaws, grinders with cutting disks, horizontal and vertical bandsaws, etc., and selection criteria.
    - Characteristics of marking out instruments, and selection criteria: marking gauge, compass, dividers, etc.

2. Drill holes using a portable drill and a drill press.
    - Characteristics of a well-sharpened drill bit.
    - Methods of sharpening a drill bit.
    - Manual reaming technique.
    - Formulas for calculating the rotation speed of the drill bit.
    - Use of accessories for holding workpieces.
    - Connection between the pressure exerted on the drill and the feed rate.

3. Grind workpieces using a sander, a file and a portable grinder.
    - Method of marking out workpieces.
    - Characteristics and use of grinding tools, and selection criteria: sander, file, grinder, grinding wheel, etc.

4. Tap holes and thread rods.
    - Method of installing the different types of threaded inserts.
    - Tapping method.
    - Threading method.
    - Importance of lubrication during tapping and threading operations.
    - Use of templates (e.g. thread chaser) to determine the thread pitch.

5. Extract bolts.
    - Types of extractors.
    - Determination of drilling diameter required.
    - Use of tap wrench.
    - Methods for extracting bolts, and troubleshooting methods.

6. Bolt components together.
    - Distinction among the different sizes of wrenches and sockets in the imperial and metric systems.
    - Use of clamping tools: wrench, pan sockets, torque wrench, impact wrench, ratcheting wrench, etc.
    - Units of measurement of torque: newton metre (N m), pound-force per foot (lbf-ft) and pound-force per inch (lbf-in).
    - Locating of nuts and bolts in the technical documentation to determine their thread pitch, length, diameter and grade.
    - Usefulness of the different types of washers, nuts and bolts: flat washer, lock washer, locknut, etc.

Cutting and Welding	Code: 782955

Competency 6 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency	**Achievement Context**
Cut and weld metals.	• Given: – ferrous and non-ferrous metals (e.g. steel, aluminum, stainless steel) in sheets, plates or tubes – verbal or written orders. • Using: – personal and collective protective equipment – the setups and accessories needed to cut and weld – consumables – technical documentation.

Elements of the Competency	**Performance Criteria**
1. Heat metal workpieces using an oxyfuel cutting setup.	• Correct start-up and adjustment of oxyfuel cutting setup. • Compliance with heating method. • Proper heating of workpieces. • Absence of distortion. • Observance of the shutdown procedure for an oxyfuel cutting setup.
2. Cut steel workpieces using an oxyfuel cutting setup.	• Correct start-up and adjustment of oxyfuel cutting setup. • Observance of prescribed dimensions and angles. • Clean cuts. • Correct cleaning of cuts. • Observance of the shutdown procedure for an oxyfuel cutting setup.
3. Cut steel workpieces using a plasma arc cutting setup.	• Correct start-up and adjustment of plasma arc cutting setup. • Observance of prescribed dimensions and angles. • Clean cuts. • Correct cleaning of cuts. • Observance of the shutdown procedure for a plasma arc cutting setup.

4. Weld metal sheets, plates or tubes in the flat position using the shielded metal arc welding (SMAW) process.	• Proper positioning of workpieces to be welded. • Appropriate choice of electrode. • Correct adjustment of welding parameter values. • Proper tacking before welding. • Observance of the welding process. • Uniformity of bead. • Adequate penetration of weld bead. • Correct cleaning of weld. • Careful verification of the quality of the weld and, if applicable, application of corrective measures.
5. Weld metal sheets, plates or tubes in the flat position using the MIG welding process.	• Proper positioning of workpieces to be welded. • Appropriate choice of electrode wire. • Correct adjustment of welding parameter values. • Proper tacking before welding. • Observance of the welding process. • Uniformity of bead. • Adequate penetration of weld bead. • Correct cleaning of weld, if applicable. • Careful verification of the quality of the weld and, if applicable, application of corrective measures.
6. Weld metal sheets, plates or tubes in the flat position using the TIG welding process.	• Proper positioning of workpieces to be welded. • Appropriate choice of electrode. • Appropriate choice of filler metal. • Proper installation of electrode. • Correct adjustment of welding parameter values. • Proper tacking before welding. • Compliance with welding methods for the process used. • Adequate penetration of weld bead. • Correct cleaning of weld, if applicable. • Uniformity of bead. • Careful verification of the quality of the weld and, if applicable, application of corrective measures.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written orders. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations.

- Accurate determination of sequence of operations.
- Appropriate choice and use of measuring instruments, tools and equipment.
- Proper preparation of surfaces.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Health and safety rules to follow when heating, cutting and welding metal: personal and collective protective equipment, risk of fire or gas leak, etc. (review of Competency 2)
- Properties of the most common ferrous and non-ferrous metals used in welding: steel, aluminum, stainless steel, etc. (review of Competency 5)
- Use of measuring and marking-out instruments, and selection criteria (review of Competency 4 for measuring instruments).
- Reactions of metals to high temperatures.
- Preparation of surfaces before heating, cutting or welding: use of cleaners, bevelling, milling, etc.
- Methods of protecting nearby surfaces.
- English and French terminology related to cutting and welding.
- Importance of keeping the work area always organized.

1. Heat metal workpieces using an oxyfuel cutting setup.
   - Gases used with an oxyfuel cutting setup.
   - Characteristics and use of an oxyfuel cutting setup.
   - Recognition of the components of an oxyfuel cutting setup.
   - Preparation of an oxyfuel cutting setup.
   - Steps in the preparation of an oxyfuel cutting setup.
   - Adjustment of the pressure reducing valve, pressure and flame.
   - Method of ensuring uniform heating.
   - Criteria for choosing the different types of nozzles and torches.
   - Work methods to use depending on the type of metal the components to be freed or removed are made of.
   - Steps in the process of shutting down an oxyfuel cutting setup.

2. Cut steel workpieces using an oxyfuel cutting setup.
   - Gases used with an oxyfuel cutting setup.
   - Characteristics and use of an oxyfuel cutting setup.
   - Distinction among the different components of an oxyfuel cutting setup.
   - Preparation of an oxyfuel cutting setup.
   - Selection of the accessories needed for the oxyfuel cutting process: nozzles, torches, cutting tips, etc.
   - Steps in the preparation of an oxyfuel cutting setup.
   - Adjustment of the pressure reducing valve, pressure and flame.

- Oxyfuel cutting of different thickness of steel, straight-line cuts, drilling of holes, cutting in the middle of a plate, etc.
- Use of oxyfuel cutting methods.
- Methods of cleaning cuts: deburring, filing and grinding (review of Competency 5).

3. Cut steel workpieces using a plasma arc cutting setup.
   - Characteristics and use of a plasma arc cutting setup.
   - Distinction among the different components of a plasma arc cutting setup.
   - Preparation of a plasma arc cutting setup.
   - Selection of the accessories needed to plasma cut metals.
   - Steps in the preparation of a plasma arc cutting setup.
   - Adjustment of intensity.
   - Cutting of different thickness of steel, straight-line cuts, drilling of holes, cutting in the middle of a plate, etc.
   - Use of cutting methods.
   - Methods of cleaning cuts: deburring, filing and grinding (review of Competency 5).

4. Weld metal sheets, plates or tubes in the flat position using the shielded metal arc welding (SMAW) process.
   - Preparation of a shielded metal arc welding setup.
   - Criteria for choosing electrodes.
   - Adjustment of welding setup parameters.
   - Distinction among the different welding positions.
   - Methods of holding different accessories: C clamp, magnetic square, etc.
   - Butt, T or 90° assembly.
   - Purpose and use of tacking method.
   - Method of cleaning weld beads.
   - Welding bead qualities and defects.
   - Method of correcting weld beads.

5. Weld metal sheets, plates or tubes in the flat position using the MIG welding process.
   - Preparation of a MIG welding setup.
   - General characteristics of the types of electrode wires.
   - Gases used in MIG welding, and adjustment method.
   - Adjustment of welding setup parameters.
   - Distinction among the different welding positions.
   - Methods of holding different accessories: C clamp, magnetic square, etc.
   - Butt, T or 90° assembly.
   - Purpose and use of tacking method.
   - Method of cleaning weld beads.
   - Welding bead qualities and defects.
   - Method of correcting weld beads.

6. Weld metal sheets, plates or tubes in the flat position using the TIG welding process.
    - Preparation of a TIG welding setup.
    - Gases used in TIG welding, and adjustment method.
    - Criteria for choosing electrodes and filler metals.
    - Preparation of electrode.
    - Adjustment of welding setup parameters.
    - Distinction among the different welding positions.
    - Methods of holding different accessories: C clamp, magnetic square, etc.
    - Butt, T or 90° assembly.
    - Purpose and use of tacking method.
    - Method of cleaning weld beads.
    - Welding bead qualities and defects.
    - Method of correcting weld beads.

Access and Handling	Code: 782962

Competency 7 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency	**Achievement Context**
Use access and handling equipment.	• Given verbal or written orders. • Using: – personal and collective protective equipment – access and handling tools and equipment – technical documentation.
Elements of the Competency	**Performance Criteria**
1. Install and use ladders and stepladders.	• Appropriate choice of ladders or stepladders for the job. • Careful inspection of the ladders or stepladders. • Proper installation of ladders or stepladders. • Safe use of ladders or stepladders.
2. Install and use metal frame scaffolding.	• Proper installation of scaffolding. • Thorough inspection of scaffolding and accessories. • Appropriate use of scaffolding. • Appropriate disassembly sequence.
3. Lift and move loads using chain hoists, shop hoists, pallet trucks, skids, etc.	• Correct estimate of the weight of the loads. • Appropriate use of load capacity charts for lifting accessories. • Accurate determination of centre of gravity. • Appropriate choice of lifting devices and accessories. • Thorough inspection of the compliance of lifting equipment and accessories. • Planning of movements based on the characteristics of the environment. • Appropriate positioning of lifting accessories based on the centre of gravity. • Appropriate lifting and moving of loads. • Absence of damage to the object being moved, surrounding objects and work area.
4. Lift and move loads by hand.	• Correct estimate of the weight of the loads. • Planning of movements based on the characteristics of the environment. • Appropriate vertical and horizontal movements of loads. • Absence of damage to the object being moved surrounding objects and work area.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Appropriate sectioning off of work area.
- Effective communication and cooperation with the appropriate people.
- Compliance with verbal or written orders.
- Compliance with current laws, regulations and standards.
- Accurate determination of sequence of operations.
- Appropriate storage of all equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Safety rules associated with access and handling (review of Competency 2).
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Methods and equipment for marking off the work area (review of Competency 2).
- Aspects to verify when planning lifting and moving operations.
- English and French terminology related to access and handling equipment.
- Importance of keeping the work area always organized.

1. Install and use ladders and stepladders.
   - Criteria for ensuring the conformity of the equipment.
   - Materials from which ladders and step ladders are made, and their characteristics.
   - Ladder and stepladder grades (review of Competency 2).
   - Factors for the safe use of ladders and stepladders (review of Competency 2).
   - Standards and risks associated with working at a height (review of Competency 2).

2. Install and use metal frame scaffolding.
   - Components and functions of scaffolding, limitations, etc. (review of Competency 2).
   - Assembly and installation of metal frame scaffolding up to two sections high.
   - Inspection, use and adjustment of a safety harness (review of Competency 2).
   - Inspection, use, maintenance and storage of personal and collective protective equipment: safety harness, guardrails, etc.
   - Standards and risks associated with working at a height.

3. Lift and move loads using chain hoists, shop hoists, pallet trucks, skids, etc.
    - Reading of name plates on equipment.
    - Locating of weight information on a piece of equipment.
    - Locating of information about the maximum capacity of a piece of equipment or a lifting or moving accessory.
    - Locating of weight information and lifting methods in a manual.
    - Use of formulas to calculate volumes and determine the mass of a piece of equipment.
    - Conversion between imperial and metric units of measurement (review of Competency 4).
    - Ways of using slings: basket, eye and vertical.
    - Materials used to make slings and their characteristics.
    - Appropriate use of lifting signals.

4. Lift and move loads by hand.
    - Methods of handling loads by hand alone and with help (review of Competency 2).
    - Importance of positioning and ergonomics when handling loads by hand.
    - Risk factors associated with handling loads by hand.

Preparation and Installation of Watertight Ducts — Code: 782974

Competency 8 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency	**Achievement Context**
Prepare and install watertight ducts.	• Working on watertight ducts used in industrial circuits. • Given verbal or written orders. • Using: – personal and collective protective equipment – drawings and sketches – tools, equipment and consumables.

Elements of the Competency	**Performance Criteria**
1. Prepare copper pipes.	• Appropriate cutting of pipes. • Proper deburring and reaming of pipes. • Careful cleaning of pipes. • Proper application of sealants, if applicable. • Proper installation of fittings. • Appropriate assembly of pipes.
2. Prepare steel pipes.	• Appropriate cutting of pipes. • Proper deburring and reaming of pipes. • Appropriate threading of pipes. • Proper application of sealants. • Proper installation of fittings. • Appropriate assembly and clamping of pipes.
3. Prepare plastic pipes.	• Appropriate cutting of pipes. • Proper application of adhesive, if applicable. • Proper installation of fittings. • Appropriate assembly of pipes.
4. Prepare steel tubes.	• Appropriate cutting of tubes. • Proper deburring and reaming of tubes. • Precise bending of tubes. • Proper installation of fittings. • Proper flaring of tubes. • Appropriate assembly of tubes.
5. Prepare pneumatic and hydraulic hoses.	• Appropriate cutting of hoses. • Proper use of sealants, if applicable. • Proper installation of fittings. • Appropriate assembly of hoses.

6. Install ducts.	• Proper removal of ducts to be replaced, if applicable. • Proper use of sealants, if applicable. • Proper installation of fittings. • Appropriate installation of ducts. • Aesthetic appearance of installation. • Careful verification of watertightness of the circuit and appropriate corrections, if applicable. *For the competency as a whole:* • Compliance with occupational health and safety rules. • Compliance with orders, drawings and sketches. • Respect for the areas of practice of the different trades. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Accurate determination of sequence of operations. • Appropriate choice and use of tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Health and safety rules when preparing, assembling and installing watertight ducts: lockout, live work permit, work at a height, cleanliness and tidiness of work area, etc.
- Symbols used in plumbing.
- Scope of practice and qualifications required for working with gas, stationary engines, pressure vessels and plumbing.
- Steps in the effective preparation and installation of ducts.
- Application of the different types of sealants.
- English and French terminology related to watertight ducts.
- Importance of keeping the work area always organized.

1. Prepare copper pipes.
    - Types of copper pipes used in fluid circuits.
    - Important characteristics of the different types of copper pipes.
    - Brazing method and filler metals.
    - Use of a brazing torch.
    - Measurement of pipes and use of cutting tools.
    - Method of reaming copper pipes.
    - Cleaning and preparation of surfaces to be brazed.
    - Brazing techniques: combustion gas, melting point, etc.
    - Installation of the different union fittings.
    - Application of the different types of sealants.
    - Installation of the different copper fittings.

2. Prepare steel pipes.
    - Use of different types of threaders: manual threader, portable power threader, vertical power threader, etc.
    - Important characteristics of the different types of steel pipes.
    - Measurement of pipes and use of cutting tools.
    - Method of reaming steel pipes.
    - Application of the different types of sealants.
    - Installation of the different union fittings.
    - Distinction among the different types of threads.

3. Prepare plastic pipes.
    - Important characteristics of plastic pipes.
    - Measurement of pipes and use of cutting tools.
    - Application of adhesives.
    - Installation of the different union fittings.

4. Prepare steel tubes.
    - Important characteristics of the different types of steel tubes.
    - Measurement of tubes and use of cutting tools.
    - Use of bender.
    - Use of flaring tool.
    - Installation of the different union fittings.

5. Prepare pneumatic and hydraulic hoses.
    - Important characteristics of the different types of hydraulic hoses.
    - Measurement of hoses and use of cutting tools.
    - Installation of the different union fittings.

6. Install ducts.
    - Characteristics of the different types of commonly used ducts.
    - Characteristics and use of the different tools used in plumbing
    - Method of removing the different types of ducts.
    - Safe commissioning of ducts.
    - Maximum pressure of ducts, if applicable.
    - Installation of the different union fittings.
    - Means of fastening ducts and fasteners used.

Machine Tool Operations	Code: 782986

Competency 9 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency	**Achievement Context**
Perform machining operations using machine tools.	• Given verbal or written orders. • Using: – personal and collective protective equipment – technical drawings or sketches – ferrous and non-ferrous metals – a milling machine and a lathe – tools and equipment – technical documentation – consumables.

Elements of the Competency	**Performance Criteria**
1. Perform daily maintenance on machine tools.	• Careful verification of oil levels. • Proper lubrication of the components that require it. • Thorough inspection of safety devices. • Thorough detection and correction of any abnormalities.
2. Turn outside diameters over predetermined lengths.	• Appropriate mounting of workpieces to a four-jaw chuck. • Correct diameter of workpieces. • Uniform finish of turned surfaces.
3. Drill workpieces using a milling machine and a lathe.	• Conformity of hole diameters. • Squareness and concentricity of holes. • Proper positioning of holes. • Uniform finish of hole walls.
4. Turn inside diameters.	• Appropriate mounting of workpieces to a four-jaw chuck. • Correct reaming diameter. • Uniform finish of groove.
5. Face mill workpieces using a milling machine.	• Accurate determination of the origin points of the workpieces, if applicable. • Appropriate dimensions of workpieces. • Uniform surface finish.

6. Cut grooves on workpieces using a milling machine.	• Accurate determination of the origin points of the workpieces, if applicable. • Appropriate dimensions and correct positioning of grooves. • Uniform finish of grooves. *For the competency as a whole:* • Compliance with occupational health and safety rules. • Compliance with orders, drawings and sketches. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Determination of relevant sequences of machining operations. • Accurate determination of rotation speed. • Correct adjustment of rotation speed and feed rate. • Appropriate choice and use of equipment, tools, accessories and measuring instruments.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Safety rules for using machine tools.
- Use of measuring instruments: telescope gauge, micrometer, vernier calliper, etc.
- Interpretation of mechanical drawings (review of Competency 4).
- Purpose of cutting oil.
- Characteristics of different materials and distinction among them (review of Competency 5).
- Conversion between values in different units of measurement and between imperial and metric units of measurement.
- English and French terminology related to machining.
- Importance of planning the machining process.
- Importance of keeping the work area always organized.

1. Perform daily maintenance on machine tools.
   - Interpretation of oil levels.
   - Operation of safety devices.
   - Methods of lubricating machine tools.
   - Signs and detection of abnormalities: noise, vibration, etc.

2. Turn outside diameters over predetermined lengths.
    - Turning of outside diameters within a tolerance of ± 0.127 mm or ± 0.005 in.
    - Short assembly and long assembly.
    - Distinction between the characteristics of a three-jaw chuck and a four-jaw chuck.
    - Method of centring a workpiece in a four-jaw chuck.
    - Use and reading of a dial gauge.
    - Calculation of lathe feed rate and rotation speed.
    - Adjustment of lathe rotation speed and feed rate, and interpretation of tables on the lathe.
    - Adjustment of cutting tool on the lathe.
    - Locating and use of indicators on the lathe handles.
    - Use of facing, roughing and finishing techniques.

3. Drill workpieces using a milling machine and a lathe.
    - Use of countersinking and counterboring techniques.
    - Use of parallel bars.
    - Calculation of rotation speed for drilling.
    - Factors ensuring squareness and a uniform finish.

4. Turn inside diameters.
    - Turning of inside diameters within a tolerance of ± 0.127 mm or ± 0.005 in.
    - Use and reading of a dial gauge.
    - Approximate calculation of rotation speed for turning.
    - Adjustment of lathe rotation speed and feed rate.
    - Adjustment of cutting tool on the lathe.
    - Reading and use of indicators on the lathe handles.

5. Face mill workpieces using a milling machine.
    - Use of parallel bars.
    - Types of milling cutters or cutting tools and their characteristics.
    - Calculation of rotation speed.
    - Method of measuring the zero point on workpieces on the milling machine.
    - Adjustment of the milling machine’s rotation speeds and, if applicable, its feed rates.

6. Cut grooves on workpieces using a milling machine.
    - Use of parallel bars.
    - Types and characteristics of cutting tools.
    - Calculation of rotation speed.
    - Method of measuring the zero point on workpieces on the milling machine.
    - Adjustment of the milling machine’s rotation speeds and, if applicable, its feed rates.

Troubleshooting Electronic Circuits	Code: 782995

Competency 10 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency	**Achievement Context**
Troubleshoot industrial electronic circuits.	• Given: – printed circuit boards for industrial production equipment: welders, controllers, electronic motor controls, etc. – verbal or written orders. • Using: – personal and collective protective equipment – electronic circuit diagrams – technical documentation – measuring instruments and tools – replacement components and consumables.

Elements of the Competency	**Performance Criteria**
1. Analyze an equipment failure.	• Accurate interpretation of orders and diagrams. • Correct identification of the part of the circuit affected. • Careful removal of the printed circuit board, if applicable. • Plausible hypotheses as to the cause of the failure. • Accurate determination of the theoretical values at different junctions in the circuit. • Accurate identification of relevant parameters. • Thorough detection of all signs of malfunctions.
2. Make a diagnosis.	• Correct comparison of values measured with theoretical values. • Accurate determination of which component is causing the failure in the circuit. • Accurate choice of intervention to solve the problem.
3. Do a repair.	• Careful removal of a printed circuit board, if applicable. • Proper removal of defective component. • Appropriate choice of replacement component. • Proper soldering of replacement component.

4. Ensure the proper operation of an electronic circuit.	• Appropriate verifications before powering up. • Proper testing of circuit. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
5. Finish the job.	• Comprehensive and accurate record of the work done. • Appropriate cleaning of work area. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments and tools.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Importance of precision and dexterity.
- Safety rules for working with electricity.
- Functioning of a PN junction.
- Consultation of data sheets to identify the types of pins and their components.
- English and French terminology related to electronic circuits.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Analyze an equipment failure.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Symbols representing common components: diode, capacitor, resistor, transistors (bipolar and field effect), etc.
   - Types of voltage: direct, alternating and pulsating (review of Competency 3).

- Parts of electronic circuits: power supply, power, oscillation, etc.
- Visual, olfactory and thermal indicators characteristic of a defective component.
- Functioning of the different components and distinction among them: diode, capacitor, resistor, transistors (bipolar and field effect), etc. based on the data on the circuit board or a search of the numbers indicated on the components.
- Location of terminals on the components.
- Use of a multimeter:
  - measurements when the circuit is de-energized using the “diode” function
  - measurements when the circuit is live: selection of correct voltage mode (review of Competency 3)
  - other.
- Use of an oscilloscope:
  - measurement of period
  - measurement of voltage
  - duty cycle
  - other.
- Precautions to be taken to avoid breaking the printed circuit board or components.
- Method of verifying common components: diode, capacitor, resistor, transistors (bipolar and field effect), etc.
- Role of heat sinks.
- Location of the physical electrical characteristics of components that point to a defect.
- Types of defects and most probable causes.
- Voltage values: average, root mean square (RMS), peak to peak, etc.
- Acceptable tolerances between the theoretical values and the values measured.
- Measured values pointing to a defect.
- Possible methods of making temporary and permanent repairs.

2. Make a diagnosis.

- Acceptable tolerances between the theoretical values and the values measured.
- Measured values pointing to a defect.
- Types of defects and their causes.
- Possible methods of making temporary and permanent repairs.

3. Do a repair.

- Use of different tools: screwdriver, socket head screwdriver, etc.
- Desoldering method using a soldering iron, a solder pump, a solder wick, etc.
- Important characteristics of replacement components.
- Locating in the technical documentation of the characteristics of replacement components.
- Connection and disconnection of the different types of connectors on the circuit boards.
- Brazing method using a soldering iron and tin.
- Types of soldering iron tips.
- Types of soldering irons and their use: gun, station and pencil.
- Qualities of proper soldering.

4. Ensure the proper operation of an electronic circuit.
    - Method of detecting short circuits.
    - Important points to verify before powering up.
    - Powering up procedure.
    - Relevant checkpoints on an electronic circuit.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

5. Finish the work.
    - Data to be recorded (e.g. on a work order).
    - Description of electronic circuit components and defects, and importance of using the appropriate terminology: short circuit, open circuit, names of components, etc.
    - Characteristics of a clear and explicit summary of the work done.
    - Precautions to be taken when storing certain tools (e.g. cleaning and storing soldering tips).

Programming Logic Circuits	Code: 783006

Competency 11 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency	**Achievement Context**
Program logic circuits.	• Given: – a programmable Logic controller – verbal or written orders. • Using: – electrical circuit diagrams – technical documentation – measuring instruments, tools and equipment – digital tools.

Elements of the Competency	**Performance Criteria**
1. Prepare programs based on combinational and sequential logic.	• Accurate interpretation of orders and diagrams. • Proper analysis of the operation of the automated system. • Determination of the type of logic needed for the job: combinational, sequential or both. • Locating of all of the system's inputs and outputs.
2. Program combinational logic circuits.	• Determination of a functional equation for each output. • Simplification of the equation for each output. • Complete and accurate logic diagram. • Appropriate verification of the functioning of the programs in simulation mode. • Effective correction of programs, if applicable.
3. Program sequential logic circuits.	• Accurate determination of the sequence to be performed by the automated system. • Accurate representation of the sequence using a GRAFCET program. • Proper implementation of the sequence in the programmable device. • Appropriate verification of the functioning of the programs in simulation mode. • Effective correction of programs, if applicable.

4. Implement programs.	• Appropriate powering up of automated system. • Successful uploading of programs into the programmable device. • Appropriate verification of the functioning of the programs in the equipment. • Effective correction of programs, if applicable. • Correct backing up of programs. *For the competency as a whole:* • Compliance with occupational health and safety rules. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools, digital tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Safety rules for working with electricity.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Interpretation of electrical circuit diagrams.
- Use of programming software.
- English and French terminology related to logic circuits.
- Importance of keeping the work area always organized.
- Characteristics of safety devices.
- Importance of taking note of useful information.

1. Prepare programs based on combinational and sequential logic.
   - Characteristics and differentiation of combinational and sequential logic.
   - Questions to ask to determine the type of logic needed (sequential or combinational).
   - Function of inputs and input devices.
   - Function of outputs and output devices.

2. Program combinational logic circuits.
   - Methods of determining the equation for each of the system's outputs (e.g. truth table).
   - Symbols and operation of logic gates.
   - Logical operators: *and*, *or*, *not*, *and not* and *or not.*
   - Use of methods for simplifying a combinatorial equation (e.g. Karnaugh map).
   - Use of the software in simulation mode.
   - Methods of verifying a program in simulation mode.
   - Methods of modifying a program.

3. Program sequential logic circuits.
   - Important points of the GRAFCET standard.
   - Operation of a GRAFCET program and related vocabulary.
   - Solving of sequential logic problems using the GRAFCET method:
     - linear GRAFCET
     - GRAFCET in a particular configuration: divergence, *AND* convergence and *OR* convergence
     - specific sequences: skip steps, resume steps, resume cycle, etc.
   - Use of counters, time delays, etc.
   - Use of the software in simulation mode.
   - Methods of verifying a program in simulation mode.
   - Methods of modifying a program.

4. Implement programs.
   - Downloading of a program in a programmable device such as a safety relay or a programmable relay.
   - Locating of the computer's communication ports.
   - Communication methods for transferring the program.
   - Modification of the network's communication parameters.
   - Use of the software in simulation or real-time operation mode.
   - Start-up of system after uploading the program.
   - Method of verifying the effectiveness of a program in a system.
   - Correction, modification or improvement of a program by adding a counter or time delay, modifying the activation conditions of an output, etc.

Maintaining and Troubleshooting Mechanical Systems	Code: 783016

Competency 12 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency	**Achievement Context**
Maintain and troubleshoot mechanical systems.	• Given: – mechanical systems including belt- or chain-drive systems, bearings and at least one speed reduction unit – verbal or written orders. • Using: – personal and collective protective equipment – mechanical drawings – technical documentation – measuring instruments, tools and equipment – replacement components and consumables.
Elements of the Competency	**Performance Criteria**
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Determination of logical sequence of operations. • Accurate determination of lubricants to use, if applicable.
2. Perform preventive maintenance on a mechanical system.	• Accurate evaluation of the condition of the components. • Appropriate alignment, adjustment and cleaning. • Appropriate verification of lubrication. • Proper lubrication, if applicable. • Proper replacement of components, if applicable.
3. Troubleshoot a mechanical system.	• Correct analysis of the failure. • Correct location of the sector affected. • Plausible hypotheses as to the cause of the failure. • Logical diagnostic method. • Accurate recording of the placement and position of components.

	• Logical disassembly and reassembly sequences. • Proper removal of components. • Accurate evaluation of the condition of the components. • Accurate determination of the cause of the failure. • Proper repair or replacement of an element. • Appropriate choice of replacement components, if applicable. • Proper reinstallation of components. • Appropriate alignment and adjustment of components.
4. Ensure the proper operation of a mechanical system.	• Thorough verification of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
5. Finish the work.	• Comprehensive and accurate record of the work done. • Appropriate cleaning of work area. • Appropriate storage of all measuring instruments, tools and equipment.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with orders and diagrams. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Lockout procedure and, if applicable, other methods of controlling energy (review of Competency 2).
- Working live work procedure (review of Competency 2).
- Risks associated with working on mechanical systems.
- English and French terminology related to mechanical systems.
- Use of rigging equipment and accessories (review of Competency 7).

- Rigging methods.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of keeping the work area always organized.
- Importance of taking note of useful information.

1. Prepare the work.
   - Terminology related to mechanical work: types of tasks, names of components, etc.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Grades and types of oil and grease.
   - Locating in the technical documentation of the type of lubricant needed.
   - Interpretation of mechanical drawings.
   - Analysis of mechanical systems: type of mechanical system, assembly methods used, possible adjustment methods, possible disassembly methods, etc.
   - Tools needed for the different mechanical tasks.

2. Perform preventive maintenance on a mechanical system.
   - Use of a grease gun and replacement of cartridge.
   - Locating of mechanical maintenance instructions in the technical documentation.
   - Criteria for selecting replacement components.
   - Locating of mechanical part numbers in the technical documentation.
   - Method of verifying the oil level in a speed reduction unit.
   - Method of verifying the alignment of pulleys, chain sprockets and gears.
   - Calculation, verification and adjustment of the allowance for the amount of slack of a chain.
   - Methods of verifying the wear on a chain.
   - Calculation, verification and adjustment of the tension of a belt.
   - Detection of signs of wear on mechanical parts: belts, pulleys, chains, couplers, etc.
   - Criteria for selecting a replacement part: speed reduction unit, bearing, belt, pulley, chain, coupler, etc.
   - Use of chemicals: thread-locking compound, penetrating oil, anti-seize compound, etc.

3. Troubleshoot a mechanical system.
   - Mechanical logic: analysis of system to locate the failure.
   - Possible defects, causes and means of detection: noise, vibration, abnormal odour, high temperature, etc.
   - Acceptable tolerances between the theoretical values and the values measured.
   - Measured values pointing to a defect.
   - Possible methods of making temporary or permanent repairs.
   - Detection of signs of wear on mechanical parts: belts, pulleys, chains, couplers, etc.
   - Use of sketches, for example, to note the position of the mechanical parts.

- Methods of assembling, holding and disassembling mechanical parts: conical mounting sleeve, set screw, etc.
- Criteria for determining the condition of parts such as speed reduction units, bearings, belts, pulleys chains and couplers.
- Disassembly of mechanical parts: use of disassembly procedure, method of identifying components, recording of data.
- Use of tools: extractor, torch, press, stamping tools, etc.
- Criteria for selecting a replacement part: speed reduction unit, bearing, belt, pulley, chain, coupler, etc.
- Methods of aligning pulleys, chain wheels, couplers and gears, for example, using a ruler or a line
- Correction of foot adjustments.
- Locating of mechanical part numbers in the technical documentation.
- Use of chemicals: thread-locking compound, penetrating oil, anti-seize compound, etc.

4. Ensure the proper operation of a mechanical system.

- Important points to verify on a mechanical system before start-up.
- Importance of installing safety devices before testing.
- Powering up procedure.
- Mechanical system start-up and test procedures.
- Signs to observe to detect failures and means of detection: noise, vibration, abnormal odour, high temperature, etc.
- Calculation of parameters: speed, gear ratio, etc.
- Method of measuring and verifying mechanical parameters: rotation speed, linear speed, etc.
- Possible solutions to a problem.
- Criteria for choosing the best solution.

5. Finish the work.

- Data to be recorded (e.g. on a work order).
- Precautions to be taken when storing certain tools.
- Importance of precision.

Pneumatic and Electropneumatic Circuits	Code: 783027

Competency 13 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Install, maintain and troubleshoot pneumatic and electropneumatic circuits.

Achievement Context

- Given:
  - pneumatic circuits
  - electropneumatic circuits controlled by relay logic or a programmable device
  - verbal or written orders.
- Using:
  - personal and collective protective equipment
  - electrical circuit diagrams
  - pneumatic circuit diagrams
  - information explaining how the program works, if applicable
  - technical documentation
  - measuring instruments, tools and equipment
  - components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Correct choice of components. • Appropriate choice of consumables.
2. Assemble and connect pneumatic components.	• Proper positioning and installation of pneumatic components. • Aesthetic appearance of the pneumatic circuit. • Solidity of connections. • Absence of leaks. • Assembly compliant with pneumatic circuit diagram. • Marking of components compliant with pneumatic circuit diagram.
3. Assemble and connect electrical components.	• Proper positioning of electrical components. • Aesthetic appearance of electrical circuit. • Correct identification of wires and components, if applicable. • Proper preparation and installation of wires. • Connections compliant with electrical circuit diagram. • Proper adjustment of sensors.

4. Perform preventive maintenance on pneumatic and electropneumatic circuits.	• Appropriate verification of the parameters of the systems and the sensors, and corrective measures, if applicable. • Meticulous detection of leaks. • Proper verification, adjustment and cleaning of conditioning unit.
5. Troubleshoot pneumatic and electropneumatic circuits.	• Correct analysis of failure. • Correct locating of sector or identification of stage of the failure. • Plausible hypotheses as to the cause of the failure. • Logical diagnostic method. • Accurate determination of appropriate corrective measure. • Appropriate choice of replacement components, if applicable. • Proper removal of defective components, if applicable. • Proper installation and adjustment of replacement components, if applicable. • Full correction of problem.
6. Ensure the proper operation of pneumatic and electropneumatic circuits.	• Thorough inspection of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrections, if necessary.
7. Finish the work.	• Comprehensive and accurate record of the work done. • Appropriate cleaning of work area. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Lockout and, if applicable, other method of controlling energy (review of Competency 2).
- Risks associated with compressed air (review of Competency 2).
- Standards for working on live electrical circuits (review of Competency 2).
- Connection between air pressure, contact surface and force.
- Connection between air flow, actuator volume and speed.
- Connection between air pressure, volume and temperature.
- Search method in technical documentation.
- English and French terminology related to pneumatic and electropneumatic circuits.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Prepare the work.
    - Questions to ask to gather information about the job to be done.
    - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
    - Locating of expected parameters in the technical documentation.
    - Interpretation of electrical circuit diagrams (review of Competency 3) and pneumatic circuit diagrams: symbols and standards for identifying components.
    - Verification of the operation of the system using technical documentation.
    - Important aspects for selecting an electrical component (review of Competency 3) and a pneumatic component.
    - Types of threads on pneumatic components.
    - Types of pneumatic fittings.
    - Colours and gauges of electrical conductors (review of Competency 3).

2. Assemble and connect pneumatic components.
    - Cutting of ducts.
    - Arrangement of pneumatic components.
    - Types of sealants (review of Competency 8).
    - Locating of orifices in pneumatic components.
    - Methods of connecting ducts.
    - Logical sequence of operations for assembling components and connecting ducts.

3. Assemble and connect electrical components.
    - Cutting and stripping of conductors (review of Competency 3).
    - Interpretation of electrical circuit diagrams: wiring diagram and ladder diagram (review of Competency 3).
    - Installation of grommets for conductor.
    - Common tools and their uses: pliers, wire stripper, crimper, screwdriver (review of Competency 3).
    - Methods used to mark wires.
    - Types of proximity sensors: magnetic, inductive, capacitive, etc.
    - Locating of terminals on the electrical components.
    - Connection of limit and proximity switches (NPN and PNP).

4. Perform preventive maintenance on pneumatic and electropneumatic circuits.
    - Methods of adjusting servo speed or the rotation of a pneumatic motor.
    - Operation and, if applicable, adjustment of the different pneumatic components: regulator, filter regulator lubricator (FRL), sequence valve, flow regulator, quick-release valve, etc.
    - Criteria for choosing the oil.
    - Means of checking for internal and external air leaks.
    - Use of measuring instruments.

5. Troubleshoot pneumatic and electropneumatic circuits.
    - Interpretation of electrical and pneumatic circuit diagrams.
    - Reading of simple programs in ladder diagrams or GRAFCET diagrams.
    - Determination of the sequence and operation of a circuit based on the diagrams.
    - Logical troubleshooting method to quickly identify the sector where the failure occurred.
    - Use of measuring instruments.
    - Important aspects of replacing a component.
    - Replacement of joints on servos or regulators.
    - Method of inspecting electrical and pneumatic components: solenoid, relay, sensor, servo, regulator, etc.

6. Ensure the proper operation of pneumatic and electropneumatic circuits.
    - Operation of basic safety devices.
    - Importance of installing mechanical safety devices before testing.
    - Important points to verify before powering up.
    - Powering up of pneumatic and electropneumatic circuits.
    - Reading of measuring instruments.
    - Comparison of the parameters measured with the expected parameters.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

7. Finish the work.
    - Data to be recorded (e.g. on a work order).
    - Terminology used to describe defects.
    - Precautions to be taken when storing certain tools.

Maintaining and Troubleshooting Electric Motor Circuits	Code: 783037

Competency 14 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Maintain and troubleshoot electric motor circuits.

Achievement Context

- Given:
  - production equipment including an electric motor circuit
  - verbal or written orders.
- Using:
  - personal and collective protective equipment
  - electrical circuit diagrams
  - technical documentation
  - measuring instruments, tools and equipment
  - replacement components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Accurate recognition of the motor's characteristics.
2. Perform preventive maintenance on an electric motor circuit.	• Accurate evaluation of the condition of the components. • Appropriate verification of electrical insulation. • Appropriate verification of electrical parameters. • Appropriate adjustment of thermal overload relays. • Proper replacement of components, if applicable.
3. Troubleshoot an electric motor circuit.	• Correct analysis of the failure. • Correct identification of the part affected. • Plausible hypotheses as to the cause of the failure. • Logical diagnostic method. • Taking of measurements and collection of relevant information. • Accurate determination of the cause of the failure. • Appropriate choice of replacement components, if applicable. • Correct repair or replacement of components. • Proper reinstallation of components.

4. Ensure the proper operation of an electric motor circuit.	• Thorough verification of safety devices. • Appropriate verifications before turning power on. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
5. Record data.	• Complete and accurate record of: – the work done – the values of the parameters.
6. Clean and tidy up the work area.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel and work area. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- English and French terminology related to electric motor circuits.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.
- Qualifications required in some situations.
- Use of handling equipment and accessories (review of Competency 7).
- Handling methods.

1. Prepare the work.
   - Terminology used to describe the tasks to be performed on an electric motor circuit.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders 3).
   - Locating and interpreting in an electrical circuit diagram of the symbols representing electrical components and sources: transformers, relays, power supplies, pushbutton contacts, fuses, thermal overload relays, motors, etc.
   - Locating of terminals on the components.
   - Interpretation of the functioning of the circuit.
   - Physical and electrical characteristics of the most common types of motors used in industry.
   - Locating of the current-carrying capacity of a conductor.
   - Locating of the electrical standards required for motor circuits.
   - Calculation of nominal current based on power and voltage for a single-phase and three-phase circuit.

2. Perform preventive maintenance on an electric motor circuit.
   - Locating of information on the motor's name plate.
   - Verification of the compliance of the electrical installation of the motor circuit.
   - Use of a megohmmeter for an electrical isolation test.
   - Common tools and their uses: pliers, wire stripper, crimper, screwdriver, wrenches (review of competencies 3 and 5).
   - Adjustment of thermal overload and time delay relays.
   - Method of cleaning a motor.
   - Verification of the wear of motor and motor circuit parts: brake, brush, commutator, power relay contact, etc.
   - Criteria for choosing replacement parts.
   - Method of removing and reinstalling the different parts.

3. Troubleshoot an electric motor circuit.
   - Acceptable tolerances between the theoretical values and the values measured (review of Competency 3).
   - Measuring instrument insulation categories (review of Competency 3).
   - Use of a multimeter and a clamp-on ammeter (review of Competency 3).
   - Characteristics and use of pliers, wire strippers, crimpers, screwdrivers, wrenches, etc., and selection criteria (review of competencies 3 and 5).
   - Measured values pointing to a defect.
   - Types of defects and their causes.
   - Possible methods of making temporary or permanent repairs.
   - Locating of part numbers in the technical documentation.
   - Characteristics of replacement parts, and selection criteria.
   - Replacement of motor parts: bearing, brake, brush, etc.
   - Replacement of motor circuit parts: time delay relay, power relay, circuit breaker, etc.
   - Replacement of a motor with an equivalent motor.
   - Methods of aligning pulleys, chain wheels, couplers and gears, for example, using a ruler or a line (review of Competency 12).

4. Ensure the proper operation of an electric motor circuit.
    - Operation of the different parts of a safety system.
    - Important points to verify before turning power on.
    - Measures to take before turning power on.
    - Method of detecting short circuits.
    - Procedure for turning power on.
    - Important measures to take when verifying the operation of the circuit.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

5. Record data.
    - Importance of clear and precise data.
    - Data to be recorded (e.g. on a work order).
    - Description of motor circuit components and defects: importance of using the appropriate terminology in the electrical circuit diagram or technical documentation (short circuit, open circuit, names of components, etc.)
    - Characteristics of a clear and explicit summary of the work done.

6. Clean and tidy up the work area.
    - Risks associated with the presence of material or debris in the control panel.
    - Importance of carefully storing tools and measuring instruments.

Hydraulic and Electrohydraulic Circuits	Code: 783047

Competency 15 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Install, maintain and troubleshoot hydraulic and electrohydraulic circuits.

Achievement Context

- Given:
  - hydraulic circuits
  - electrohydraulic circuits controlled by relay logic, a programmable relay or a programmable controller
  - verbal or written orders.
- Using:
  - personal and collective protective equipment
  - electrical circuit diagrams
  - hydraulic circuit diagrams
  - information explaining how the program works, if applicable
  - the equipment's operating parameters
  - technical documentation
  - measuring instruments, tools and equipment
  - components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Correct choice of components. • Appropriate choice of consumables.
2. Assemble and connect hydraulic components.	• Proper positioning and installation of hydraulic components. • Aesthetic appearance of hydraulic circuit. • Solidity of connections. • Absence of leaks. • Assembly compliant with hydraulic circuit diagram. • Marking of components compliant with hydraulic circuit diagram.
3. Assemble and connect electrical components.	• Proper positioning of electrical components. • Aesthetic appearance of electrical circuit. • Correct identification of wires and components, if applicable. • Proper preparation and installation of wires. • Connections compliant with electrical circuit diagram. • Proper adjustment of sensors.

4. Perform preventive maintenance on hydraulic and electrohydraulic circuits.	• Accurate adjustment of system parameters: speed and pressure. • Precise adjustment of sensors. • Appropriate verification of absence of leaks.
5. Troubleshoot hydraulic and electrohydraulic circuits.	• Correct analysis of failure. • Correct locating of sector or identification of stage of the failure. • Plausible hypotheses as to the cause of the failure. • Logical diagnostic method. • Accurate determination of the cause of the problem. • Accurate determination of appropriate corrective measure. • Appropriate choice of replacement components, if applicable. • Proper removal of defective components, if applicable. • Proper installation and adjustment of replacement components, if applicable. • Full correction of problem.
6. Ensure the proper operation of hydraulic and electrohydraulic circuits.	• Thorough inspection of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and appropriate corrections, if necessary.
7. Finish the work.	• Comprehensive and accurate record of the work done. • Appropriate cleaning of work area. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Lockout and, if applicable, other methods of controlling energy (review of Competency 2).
- Risks associated with hydraulics.
- Standards for working on live electrical circuits (review of Competency 2).
- Connection between pressure, contact surface and force.
- Connection between oil flow, volume and speed.
- Search method in technical documentation.
- English and French terminology related to hydraulic and electrohydraulic circuits.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Prepare the work.
    - Questions to ask to gather information about the job to be done.
    - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
    - Locating of expected parameters in the technical documentation.
    - Interpretation of electrical circuit diagrams (review of Competency 3) and hydraulic circuit diagrams: symbols and standards for identifying components.
    - Determination of the operation of the system using technical documentation.
    - Important aspects for selecting an electrical component (review of Competency 3) and a hydraulic component.
    - Types of threads on hydraulic components.
    - Types of hydraulic fittings.
    - Colours and gauges of electrical conductors (review of Competency 3).

2. Assemble and connect hydraulic components.
    - Arrangement of hydraulic components.
    - Locating of orifices in hydraulic components.
    - Methods of connecting ducts.
    - Logical sequence of operations for assembling components and connecting ducts.

3. Assemble and connect electrical components.
    - Cutting and stripping of conductors (review of Competency 3).
    - Interpretation of electrical circuit diagrams: wiring diagram and ladder diagram (review of Competency 3).
    - Installation of grommets for conductor.
    - Tools and how to use them: screwdriver, pliers, wire stripper and crimper.
    - Methods used to mark wires.
    - Types of proximity sensors: magnetic, inductive, capacitive, etc.
    - Connection of limit and proximity switches (NPN and PNP).
    - Locating of terminals on the electrical components.

4. Perform preventive maintenance on hydraulic and electrohydraulic circuits.
    - Methods of adjusting servo speed or the rotation of a hydraulic motor.
    - Operation and, if applicable, adjustment of different hydraulic components: pressure-limiting device, flow regulator, etc.
    - Criteria for choosing the oil.
    - Means of checking for internal and external oil leaks.
    - Use of measuring instruments.

5. Troubleshoot hydraulic and electrohydraulic circuits.
    - Interpretation of electrical and hydraulic circuit diagrams.
    - Interpretation of simple programs in ladder diagrams or GRAFCET diagrams.
    - Determination of the sequence and operation of a circuit based on the diagrams.
    - Method to quickly identify the sector where the failure occurred.
    - Use of measuring instruments.
    - Important aspects of replacing a component.
    - Replacement of joints on servos or regulators.
    - Method of inspecting electrical and hydraulic components: solenoid, relay, sensor, servo, regulator, etc.

6. Ensure the proper operation of hydraulic and electrohydraulic circuits.
    - Operation of basic safety devices.
    - Importance of installing mechanical safety devices before testing.
    - Important points to verify before powering up.
    - Powering up of hydraulic and electrohydraulic circuits.
    - Reading of measuring instruments.
    - Comparison of the parameters measured with the expected parameters.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

7. Finish the work.
    - Data to be recorded (e.g. on a work order).
    - Terminology used in electricity and hydraulics.
    - Terminology used to describe defects.
    - Importance of a clean and tidy work area.
    - Precautions to be taken when storing certain tools.

Electronic Motor Control Devices	Code: 783055

Competency 16 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Install and calibrate electronic motor control devices.

Achievement Context

- Given:
  - a piece of equipment including an electronic motor control device such as a soft starter, a variable speed drive or a servomotor
  - verbal or written orders.
- Using:
  - personal and collective protective equipment
  - electrical circuit diagrams
  - technical documentation
  - measuring instruments, tools and equipment
  - digital tools
  - components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Gathering of information needed to calibrate the electronic motor control device. • Logical determination of steps in the work process. • Proper marking of wires, if applicable.
2. Perform the mechanical installation of the electronic motor control device.	• Proper removal of electronic motor control device to be replaced, if applicable. • Solid fastening of new electronic motor control device. • Proper positioning of electronic motor control device in the panel. • Aesthetic appearance of installation.
3. Connect the electronic motor control device.	• Accurate location of terminal screws. • Accurate location of wires to be connected. • Proper preparation and installation of wires. • Connections compliant with the circuit diagram.
4. Power up the equipment.	• Appropriate verifications before powering up. • Careful inspection of safety devices. • Proper powering up of equipment.

5. Modify the parameter values in the electronic motor control device.	• Appropriate use of programming keyboard. • Effective use of programming software. • Proper modification of the main parameters required for the device to operate correctly.
6. Do tests.	• Relevant measurements taken. • Careful verification of the operating parameters and application of the appropriate corrective measures, if necessary.
7. Record the data.	• Complete and accurate record of: – the work done – the parameters of the electronic device – the parameters of the circuit.
8. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- English and French terminology related to electronic motor control devices.
- Safety standards for working with electricity (review of Competency 2).
- Method of finding information in technical documentation.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.
- Types of signals: on/off, analog (4-20 mA, 0-10 V, etc.), etc.

1. Prepare the work.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Locating of information on an electric motor's name plate (review of Competency 14).
   - Important data for parameterizing and installing an electronic motor control device.
   - Identification of the parameters of the electronic motor control device.
   - Important characteristics of a motor for parameterizing and installing an electronic motor control device (review of Competency 14).
   - Characteristics and use of pliers, wire strippers, crimpers and screwdrivers, and selection criteria (review of Competency 3).
   - Types and gauges of conductors (review of Competency 3).
   - Criteria for choosing an electronic motor control device.
   - Interpretation of electrical circuit diagrams (review of Competency 3).

2. Perform the mechanical installation of the electronic motor control device.
   - Importance of clearing a space around the electronic motor control device.
   - Importance and purpose of the recommended components: heat sink, inductor, fan, etc.
   - Interpretation of mechanical drawings.
   - Shopwork: drilling, threading, etc. (review of Competency 5).
   - Characteristics of an appropriate installation.

3. Connect the electronic motor control device.
   - Locating of terminals on the components.
   - Connection methods: types of terminal blocks, ferrules, etc.
   - Terminology related to the terminal screws found on electronic motor control devices.
   - Purpose of shielded cables.
   - Preparation and installation of conductors: cutting, stripping, installation of ferrules, tinning, etc.
   - Importance of appropriate tightening of connecting screws.

4. Power up the equipment.
   - Importance of installing mechanical safety devices before testing.
   - Important points to verify before powering up.
   - Method of detecting short circuits.
   - Powering up procedure.

5. Modify the parameter values in the electronic motor control device.
    - Locating of the correct parameters in the technical documentation.
    - Locating and modification of parameters directly on the device, using an application, etc.
    - Use of programming software.
    - Effects of parameters on the motor's operation.
    - Determination of certain parameters related to the motor's characteristics.
    - Main parameters required for proper operation: nominal motor parameters, acceleration and deceleration, minimum and maximum speed, run switch, speed setpoint, load characteristics, etc.

6. Do tests.
    - Measuring instrument insulation categories (review of Competency 3).
    - Use of a multimeter and a clamp-on ammeter (review of Competency 3).
    - Use of a megohmmeter for an electrical isolation test (review of Competency 14).
    - Important measures to take when verifying the operation of the circuit.
    - Comparison of the parameters measured with the expected parameters.
    - Signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

7. Record data.
    - Importance of clear and precise data.
    - Data to be recorded (e.g. on a work order).
    - Terminology used to describe parameters: acceleration, deceleration, etc.
    - Characteristics of a clear and explicit summary of the work done.

8. Clean and tidy up.
    - Risks associated with the presence of material or debris in the control panel.
    - Importance of carefully storing tools and measuring instruments.

Control Loops	Code: 783065

Competency 17 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency	**Achievement Context**
Connect and calibrate control loops.	• Given: – a control loop with process instruments installed but not connected – verbal or written orders. • Using: – personal and collective protective equipment – electrical circuit diagrams – technical documentation – tools and measuring instruments – components and consumables.

Elements of the Competency	**Performance Criteria**
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Accurate location of the different elements in the loop. • Logical determination of steps in the work process. • Appropriate choice of consumables, if applicable.
2. Connect the elements of the control loop.	• Accurate location of terminal screws. • Accurate location of wires to be connected. • Proper marking of wires, if applicable. • Proper preparation and installation of wires. • Connections compliant with electrical circuit diagram.
3. Power up the automated system.	• Appropriate verifications before powering up. • Careful inspection of safety devices. • Appropriate powering up of automated system.
4. Calibrate the measuring instrument, if applicable.	• Proper calibration of instrument. • Verification of the accuracy of the value measured.
5. Calibrate the final element, if applicable.	• Proper adjustment of the parameters needed for proper operation.

6. Set the parameters in the process controller.	• Appropriate selection of type of input. • Proper adjustment of normal input range, if applicable. • Proper assignment of outputs. • Proper adjustment of alarm. • Proper adjustment of PID (proportional integral derivative control) variables.
7. Do tests.	• Relevant measurements taken. • Careful verification of the operating parameters and application of the appropriate corrective measures, if necessary.
8. Record the parameters.	• Complete and accurate record of: – the parameters of the instruments – the parameters of the system.
9. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments and tools.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Method of finding information in technical documentation.
- English and French terminology related to control loops.
- Importance of keeping the work area always organized.

- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Prepare the work.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Letters designating the elements of a control loop.
   - Interpretation of electropneumatic and electrohydraulic circuit diagrams (review of competencies 4, 13 and 15), and flow charts.
   - Types of hand tools: screwdriver, wire stripper, crimper, etc. (review of Competency 3).
   - Measuring instruments used to measure process variables: multimeter, thermometer, pressure gauge, flowmeter, chronometer, etc. (review of competencies 3, 13 and 15).
   - Measuring instrument insulation categories (review of competencies 2 and 3).
   - Characteristics and use of pliers, wire strippers, crimpers and screwdrivers, and selection criteria (review of Competency 3).
   - Types and gauges of conductors (review of Competency 3).
   - Connection methods: types of terminal blocks, ferrules, etc.

2. Connect the elements of the control loop.
   - Recognition of the different types of measuring instruments and their operating principles: flowmeter, pressure transmitter, thermocouple, encoder, potentiometer, etc.
   - Distinction between the different types of active and passive transmitters.
   - Recognition of the final control elements and their operating principles: pump, motor, modulating valve, solid-state relay, pneumatic and hydraulic proportional regulators, etc.
   - Recognition of the control elements, controllers and regulators and their operating principles.
   - Selection of wires and cables (review of Competency 4).
   - Names of instrument terminals: input 1, output 2, etc.
   - Types of regulator outputs: 4-20 mA, contact, transistor, etc.
   - Types of signals: on/off, analog (4-20 mA, 0-10 V, etc.), etc.
   - Operation of the different types of terminal blocks.
   - Preparation and installation of conductors: cutting, stripping, installation of ferrules, tinning, etc.
   - Importance of appropriate tightening of connecting screws.

3. Power up the automated system.
   - Importance of installing mechanical safety devices before testing.
   - Important points to verify before powering up.
   - Method of detecting short circuits.
   - Powering up procedure.

4. Calibrate the measuring instrument, if applicable.
   - Procedure for setting measuring instruments to zero.
   - Parameters: units of measurement, input filtration, measurement scale, etc.
   - Use and reading of measuring instruments: pressure gauge, infrared camera, etc.
   - Units of measurement for processes: litres per minute (LPM), revolutions per minute (RPM), centimetres (cm), etc.
   - Conversion of units of measurement: degrees Celsius to degrees Fahrenheit, litres to gallons, etc.

5. Calibrate the final element, if applicable.
    - Modification of the parameters of a variable frequency drive for a remote setpoint (review of Competency 16).
    - Important parameters for the proper operation of the final control elements: operating mode, type of signal, minimum and maximum, etc.

6. Set the parameters in the process controller.
    - Main parameters and their functions: type of alarm, type of input, assignment of outputs, setpoints, etc.
    - Characteristics of PID control.
    - Impact of PID variables on the process response.
    - Method of adjusting PID variables.

7. Do tests.
    - Operation of regulator in manual and automatic mode.
    - Analysis of indicators on the regulator.
    - Comparison of the parameters measured with the expected parameters.
    - Verification of alarms.

8. Record the parameters.
    - Data to be recorded (e.g. on a work order).
    - Method of recording parameters.
    - Importance of clear written communication and precise, accurate parameters.

9. Clean and tidy up.
    - Importance of carefully storing tools and measuring instruments.
    - Hazards related to poor organization of the work area.

Programming Automated Systems	Code: 783077

Competency 18 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency	**Achievement Context**
Program automated systems.	• Given: – an automated system with a programmable controller, a human-machine interface (HMI) and a robotic cell – verbal or written orders. • Using: – programming plans – electrical circuit diagrams – technical documentation – measuring instruments, tools and components – digital tools.
Elements of the Competency	**Performance Criteria**
1. Prepare the work.	• Accurate interpretation of orders, diagrams and drawings. • Accurate location of the elements of the automated system needed for programming. • Collection of data needed for programming. • Careful inspection of electrical connections • Accurate recognition of: – communication networks – memory structure – operating modes.
2. Program the devices.	• Effective use of programming software. • Accurate location of input/output elements. • Accurate determination of combinational and sequential operations. • Accurate determination of operating modes. • Proper programming of devices.
3. Power up the automated system.	• Careful inspection of safety devices. • Appropriate verifications before powering up. • Appropriate powering up of automated system.
4. Implement a program.	• Careful verification of the configuration of the devices. • Proper importing and backing up of program, if applicable. • Successful uploading of program. • Effective communication between the human-machine interface (HMI) and the controller.

5. Do tests.	• Correspondence between the inputs and outputs. • Careful verification of the operating sequence and parameters and application of the appropriate corrective measures, if necessary.
6. Record data.	• Correct backing up of program. • Complete and accurate recording of important data.
7. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders, diagrams and drawings. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments and tools.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Use of digital tools such as programming software programs.
- Safety standards for working with electricity (review of Competency 2).
- Risks associated with working with a robotic cell.
- Method of finding information in technical documentation.
- English and French terminology related to automated systems and programming.
- Importance of keeping the work area always organized.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Prepare the work.
    - Questions to ask to gather information about the job to be done.
    - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
    - Physical aspect of components: monoblock controller, input and output boards, human-machine interface (HMI), etc.
    - Reading of name plates on equipment.
    - Interpretation of programming plans (e.g. GRAFCET).
    - Structure of the controller: central processing unit (CPU), input and output modules, and power modules.
    - Components of a robotic cell: controller, teach pendant, etc.
    - Recognition of the different components used.
    - Locating of axes on a robot.
    - Connection of inputs and outputs.
    - Connection of safety devices.
    - Interpretation of electrical circuit diagrams.
    - Travel modes and reference positions of robots.
    - Main operating modes: automatic, manual, single step, etc.
    - Main stop modes: safety, emergency, end of cycle, etc.

2. Program the devices.
    - Start-up and shutdown of programs.
    - Programming languages: ladder diagram, function block, structured language, GRAFCET, etc.
    - Program architecture.
    - Definition of variables: addresses, symbols, etc.
    - Basic instructions: dwell, count up or count down, mathematical instructions, conversion instructions, etc.
    - Methods of programming operating modes: automatic, manual, single step, etc.
    - Methods of programming stop modes: safety, emergency, end of cycle, etc.
    - Modification and adding of programming points, and motion lag in a robotic cell.
    - Use of a teach pendant for a robotic cell.

3. Power up the automated system.
    - Operation of different safety systems and their components: safety curtain, emergency shutdown, safety line, safety relay, etc.
    - Important points to verify before powering up.
    - Procedure for powering up an automated system.

4. Implement a program.
    - Types of boards available and configurations needed.
    - Modification of the configuration of the instrument network so that the instruments can communicate with each other.
    - Communication test to verify the connection between the devices.
    - Importing of programs already in the devices.

5. Do tests.
    - Viewing of a program online.
    - Forcing of inputs and outputs.
    - Possible solutions to a problem.
    - Criteria for choosing the best solution.
    - Modification of programs online and offline.

6. Record the data.
    - Backing up of device programs: controller, human-machine interface (HMI), robot controller, etc.
    - Data to be recorded (e.g. on a work order).

7. Clean and tidy up.
    - Risks associated with the presence of material or debris in the control panel.
    - Importance of carefully storing measuring instruments and tools.

Planned Automated System Maintenance	Code: 783085

Competency 19 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Implement a planned automated system maintenance program.

Achievement Context

- Given:
  - a functional automated system including a control loop and a controller
  - a robotic cell
  - a compressor
  - a hydraulic unit
  - verbal orders or a work order.
- Using:
  - personal and collective protective equipment
  - pneumatic, hydraulic, electrical and mechanical circuit diagrams
  - technical documentation
  - digital tools
  - measuring instruments, tools and equipment
  - replacement components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders and diagrams. • Accurate locating on the work order of the work to be done. • Appropriate verification of the equipment's maintenance history. • Planning of logical sequence of tasks.
2. Perform preventive maintenance on the pneumatic system and its power supply.	• Proper verification, adjustment and cleaning of compressor. • Proper maintenance of air conditioning unit. • Thorough detection and correction of leaks. • Appropriate verification and correction of parameters.
3. Perform preventive maintenance on the hydraulic system and its power supply.	• Proper verification, adjustment and cleaning of hydraulic unit. • Thorough detection and correction of leaks. • Appropriate verification and correction of parameters.

4. Perform preventive maintenance on the electrical system.	• Correct backing up of program. • Accurate verification of precision of measuring instruments and application of the appropriate corrective measures, if necessary. • Performance of compliant isolation tests on motors and transformers. • Appropriate cleaning of electrical cabinet and, if applicable, verification of ventilation. • Careful verification of the integrity of the electrical cables and connections and application of appropriate corrective measures, if necessary.
5. Perform preventive maintenance on the mechanical system.	• Careful verification of: – speed reduction unit oil levels – wear on transmission devices (belts and chains) – alignment of pulleys and chain wheels. • Appropriate draining of oil from a variable speed drive or speed reduction unit. • Appropriate lubrication of mechanical system. • Appropriate correction of minor problems detected.
6. Do a planned repair on an automated system.	• Accurate recording of the placement and position of components. • Logical disassembly sequence. • Proper removal of components. • Proper choice of replacement components. • Correct repair or replacement of components. • Logical reassembly sequence. • Proper reinstallation of components.
7. Ensure the proper operation of the systems.	• Thorough verification of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
8. Record the data.	• Proper use of digital tools. • Comprehensive and accurate record of the work done.

9. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment. • Appropriate suggestions regarding maintenance and repair work.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Lockout procedure and, if applicable, other methods of controlling energy (review of Competency 2).
- Safety rules for working with electricity (review of Competency 2).
- Working live work procedure (review of Competency 2).
- Risks associated with working with a robotic cell.
- Risks associated with planned maintenance tasks.
- Use of handling equipment and accessories (review of Competency 7).
- Handling methods.
- Interpretation of pneumatic, hydraulic, electrical and mechanical circuit diagrams (review of competencies 3, 12, 13 and 15).
- Method of finding information in technical documentation (in paper and electronic format).
- Use of measuring instruments: multimeter, clamp-on ammeter, thermometer, etc. (review of competencies 3, 10 and 17).
- Characteristics and use of pliers, wrenches, screwdrivers, etc., and selection criteria (review of competencies 3 and 5).

- Reading of a pressure gauge (review of competencies 13 and 15).
- Characteristics of lubricants (review of competencies 12, 13 and 15).
- Most common preventive maintenance tasks.
- Detection of signs of an imminent failure and system weaknesses, and suggested maintenance and repair tasks.
- English and French terminology related to planned automated system maintenance.
- Importance of keeping the work area always organized.
- Categories of machine safety: characteristics and operation of components.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Prepare the work.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Browsing a maintenance software program or application.
   - Consultation of maintenance history.
   - Preparation of the replacement parts, measuring instruments, tools and equipment needed for the job.

2. Perform preventive maintenance on the pneumatic system and its power supply.
   - Types of pneumatic components (review of Competency 13).
   - Types of compressors.
   - Basic operations to perform on a compressor: verification of oil level, verification of air filter, adjustment of pressure switch, verification of safety valve, etc.
   - Cleaning of conditioning unit's air filter (review of Competency 13).
   - Adjustment of oil flow on a lubricator (review of Competency 13).
   - Detection of signs of an imminent system failure.
   - Methods of detecting internal and external air leaks, and determination of their cause (review of Competency 13).
   - Method of adjusting pneumatic components: pressure regulator, flow restrictor, time delay, etc. (review of Competency 13).

3. Perform preventive maintenance on the hydraulic system and its power supply.
   - Basic operations to perform on a hydraulic unit: verification of breather and oil levels, adjustment of pressure relief device, etc.
   - Draining of oil from a hydraulic system, importance of recycling waste oil and absorbent materials.
   - Detection of signs of an imminent system failure.
   - Methods of detecting internal and external oil leaks, and determination of their cause (review of Competency 15).
   - Components of the hydraulic unit: tank, filter, pump, breather, etc.
   - Disassembly of the components of the hydraulic unit.
   - Method of verifying the performance of the hydraulic unit.

4. Perform preventive maintenance on the electrical system.
    - Connection to the system using a digital tool (e.g. computer) (review of Competency 18).
    - Backup and restoration of an existing program (review of Competency 16).
    - Browsing through the menus of electronic devices: variable speed drives, process controllers, etc. (review of competencies 16 and 17).
    - Measuring instrument insulation categories (review of Competency 3).
    - Use of a multimeter and a clamp-on ammeter (review of Competency 3).
    - Use of a megohmmeter for an electrical isolation test (review of Competency 14).
    - Method of ensuring the accuracy of readings from measuring instruments installed on the automated system (review of Competency 17).
    - Adjustment of measuring instruments installed on the automated system (review of Competency 17).
    - Method of cleaning electrical cabinets.
    - Verification of filters and fans in the electrical cabinets.
    - Importance of appropriate tightening of connecting screws (review of Competency 3).
    - Locating of hot spots using a thermal imaging camera.
    - Replacement of batteries in the components: human-machine interface (HMI), controller, robotic cell, etc.
    - Manual movement of robot using the different position references.

5. Perform preventive maintenance on the mechanical system.
    - Method of verifying the oil level in a mechanical system (review of Competency 12).
    - Characteristics of oils and greases (review of Competency 12).
    - Use of a grease gun (review of Competency 12).
    - Basic mechanical alignment methods for pulleys, chains and couplers (review of Competency 12).
    - Characteristics of belts and chains (review of Competency 12).
    - Method of verifying the tension on a belt and the allowance on a chain (review of Competency 14).
    - Detection of signs of imminent system failure.

6. Do a planned repair on an automated system.
    - Method of drawing sketches (review of Competency 4).
    - Use of a digital tool to take photos and collect important data.
    - Locating of a replacement number on a part.
    - Important aspects to consider when replacing a part (review of competencies 3, 12, 13, 14, 15, 16, 17 and 18).
    - Disassembly and reassembly methods (review of competencies 3, 12, 13, 14, 15, 16, 17 and 18).
    - Importance of having a method of arranging removed parts to facilitate reassembly.

7. Ensure the proper operation of the systems.
    - Operation of different safety systems and their components: safety curtain, emergency shutdown, safety line, safety relay, etc.
    - Importance of installing mechanical safety devices before testing.
    - Important points to verify before powering up.
    - Method of detecting short circuits.

- Powering up procedure.
- Automated system start-up procedure.
- Operating modes of an automated system: automatic, manual, etc.
- Signs of failure.
- Possible solutions to problems.
- Criteria for choosing the best solution.

8. Record the data.
   - Use of maintenance software.
   - Data to be recorded (e.g. on a work order).

9. Clean and tidy up.
   - Importance of carefully storing tools and measuring instruments.
   - Hazards related to poor organization of the work area.

Troubleshooting Automated Systems	Code: 783097

Competency 20 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Troubleshoot automated systems.

Achievement Context

- Given:
  - a malfunctioning automated system including:
    - a programmable controller
    - a human-machine interface (HMI)
    - a variable speed drive
    - a control loop
    - mechanical, pneumatic and hydraulic components
    - a robotic cell
    - etc.
  - verbal or written orders, etc.
- Using:
  - personal and collective protective equipment
  - electrical, pneumatic and hydraulic circuit diagrams, etc.
  - technical documentation
  - measuring instruments, tools and equipment
  - replacement components and consumables.

Elements of the Competency	Performance Criteria
1. Analyze an equipment failure.	• Accurate interpretation of orders and diagrams. • Correct identification of the sector affected. • Plausible hypotheses as to the cause of the failure. • Accurate determination of required verifications and expected results. • Accurate reading of data on the circuit.
2. Make a diagnosis.	• Proper comparison of data collected with the expected results. • Accurate determination of which component is causing the failure in the circuit. • Accurate choice of intervention to solve the problem.

3. Do a repair.	• Proper removal of defective component, if applicable. • Appropriate choice of replacement component, if applicable. • Proper installation of replacement component, if applicable. • Proper repair of system.
4. Ensure the proper operation of the automated system.	• Thorough verification of safety devices. • Appropriate verifications before powering up. • Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
5. Record the data.	• Complete and accurate record of: – data – the work done.
6. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Observance of the scope of practice of an electromechanical technician. • Compliance with orders and diagrams. • Compliance with current laws, regulations and standards. • Strict observance of manufacturers' recommendations. • Effective communication and cooperation with the appropriate people. • Appropriate choice and use of measuring instruments, tools and equipment.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Lockout procedure and, if applicable, other methods of controlling energy (review of Competency 2).
- Safety rules for working with electricity (review of Competency 2).
- Working live work procedure (review of Competency 2).
- Method of searching technical documentation.
- English and French terminology related to the troubleshooting of automated systems, defects and the tasks required.
- Importance of keeping the work area always organized.
- Categories of machine safety: characteristics and operation of components.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

1. Analyze an equipment failure.
   - Questions to ask to gather relevant information about the job to be done (review of Competency 3).
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Importance of attitude toward the person asking for service.
   - Interpretation of an electrical circuit diagram (review of Competency 3).
   - Interpretation of pneumatic and electropneumatic circuit diagrams (review of Competency 13).
   - Interpretation of hydraulic and electrohydraulic circuit diagrams (review of Competency 15).
   - Division of an automated system into sectors.
   - Factors to check to quickly rule out possible causes.
   - Interpretation of indicators, messages and error codes.
   - Interpretation of input and output signals.
   - Operation of components and interactions between them.
   - Based on diagrams, determination of the normal measurements or data at different points of the automated system.
   - Choice of effective verification of sequence, considering the possible results.
   - Measuring instrument insulation categories (review of Competency 3).
   - Use of a multimeter and a clamp-on ammeter (review of Competency 3).
   - Use of a megohmmeter for an electrical isolation test (review of Competency 14).
   - Physical aspect of automated system components (review of competencies 3, 13, 14, 15, 16, 17 and 18): relays (control, power or safety), power supplies, variable speed drives, pneumatic and hydraulic regulators, terminal boards, fuses, breakers, etc.
   - Connection to a controller to view the program and the inputs and outputs (review of Competency 18).
   - Use of a teach pendant for a robotic cell.
   - Manual movement of robot using the different position references.
   - Forcing of inputs and outputs (review of Competency 18).

2. Make a diagnosis.
   - Types of defects and their observable characteristics.
   - Method of repairing the failure: cleaning, repairing a part, changing a part, etc.
   - Evaluation of the durability of the different types of repairs and the time they take in order to make the right choice.

3. Do a repair.
   - Characteristics and use of pliers, wrenches, screwdrivers, etc., and selection criteria.
   - Important characteristics to verify when replacing a part: electrical, mechanical, etc. (review of competencies 3, 12, 13, 14, 15, 16, 17 and 18).
   - Method of finding replacement parts (manual and Internet).
   - Methods of identifying components or recording data when disassembling parts (review of Competency 12).
   - Backing up and restoring of an existing program.

4. Ensure the proper operation of the automated system.
   - Operation of different safety systems and their components: safety curtain, emergency shutdown, safety line, safety relay, etc.
   - Importance of installing mechanical safety devices before testing.
   - Important points to verify before powering up.
   - Method of detecting short circuits.
   - Powering up procedure.
   - Automated system start-up procedure.
   - Operating modes of an automated system: automatic, manual, etc.
   - Signs of failure.
   - Possible solutions to problems.
   - Criteria for choosing the best solution.

5. Record the data.
   - Data to be recorded (e.g. on a work order).

6. Clean and tidy up.
   - Importance of carefully storing tools and measuring instruments.
   - Hazards related to poor organization of the work area.

Installing Automated Systems	Code: 783108

Competency 21 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Install automated systems.

Achievement Context

- Given:
  - a disassembled automated system including:
    - a programmable controller
    - a human-machine interface (HMI)
    - a variable speed drive
    - a control loop
    - mechanical, pneumatic and hydraulic components, etc.
  - verbal or written orders
  - etc.
- Using:
  - personal and collective protective equipment
  - pneumatic, hydraulic, electrical and mechanical circuit diagrams
  - installation drawings
  - technical documentation
  - measuring instruments, tools and equipment
  - replacement components and consumables.

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of orders, diagrams and drawings. • Careful examination of the characteristics of the automated system to be installed. • Accurate location of installation site. • Logical planning of tasks. • Appropriate verification of component availability and compliance. • Appropriate verification of the compliance of the electrical, pneumatic and hydraulic power supplies.
2. Install the frame for the automated system.	• Transporting of the frame to the designated location. • Proper levelling of frame. • Proper fastening or anchoring of frame.
3. Make the necessary components.	• Determination of parts to make. • Observance of steps in the making of parts. • Compliance of parts made.

4. Install the mechanical components.	• Logical order of installation. • Installation at a precise location. • Proper mechanical alignment and adjustment of components. • Solid installation.
5. Install and connect the pneumatic components.	• Logical order of installation. • Aesthetic appearance of installation and connections. • Proper connection of automated system to the building's network, if applicable.
6. Install and connect the hydraulic components.	• Logical order of installation. • Aesthetic appearance of installation and connections. • Proper connection of equipment to the building's network, if applicable.
7. Install and connect the electrical components.	• Logical order of installation. • Appropriate running of wires in the conduits, if applicable. • Aesthetic appearance of installation and connections. • Proper connection of equipment to the building's network.
8. Upload the program or programs.	• Effective connection to the controller and the human-machine interface (HMI). • Successful uploading of program or programs.
9. Start up the automated system.	• Appropriate verification of automated system before start-up. • Sequential start-up of automated system. • Modification to the parameters of the controller, variable speed drive, etc.
10. Ensure the proper operation of the automated system.	• Proper testing of equipment. • Careful verification of the effectiveness of the work and application of the appropriate corrective measures, if necessary.
11. Record the data.	• Complete and accurate record of: – the parameters of the instruments – the parameters of the system – the work done.
12. Clean and tidy up.	• Appropriate cleaning of work area. • Absence of materials or debris in the control panel. • Appropriate storage of all measuring instruments and tools.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with orders, diagrams and drawings.
- Compliance with current laws, regulations and standards.
- Strict observance of manufacturers' recommendations.
- Effective communication and cooperation with the appropriate people.
- Appropriate choice and use of equipment and tools, as well as their accessories and measuring instruments.

Suggestions for Competency-Related Knowledge and Know-How

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

For the competency as a whole:

- Safety rules for working on live equipment, locking out, handling equipment, using machine tools, doing live work, working at a height, etc.
- Use of handling equipment and accessories (review of Competency 7).
- Handling methods.
- Method of using hand tools and machine tools (review of competencies 3 and 5).
- Characteristics and operation of hand tools, and selection criteria.
- Interpretation of pneumatic, hydraulic, electrical and mechanical circuit diagrams (review of competencies 3, 12, 13 and 14).
- Importance of complying with diagrams, drawings and manufacturer's recommendations.
- English and French terminology related to the installation of automated systems.
- Importance of keeping the work area always organized.
- Categories of machine safety: characteristics and operation of components.
- Importance of effective communication and cooperation with the appropriate people: operators, co-workers, other tradespersons, superiors, etc.
- Importance of taking note of useful information.

Installing Automated Systems	Code: 783108

1. Prepare the work.
   - Questions to ask to gather information about the job to be done.
   - Methods of analyzing and interpreting verbal and written orders (e.g. work order).
   - Location of important information for an installation: name plates, technical documentation in paper and electronic format.
   - Tasks important to a complete installation and a logical sequence of operations.
   - Standards related to the job.
   - Scope of practice and qualifications required for gas, electrical and plumbing work.
   - Importance of planning the work and the installation sequence, and of meeting deadlines.
   - Distinction between electrical, mechanical, pneumatic and hydraulic components, etc.
   - Important aspects for selecting electrical, mechanical, pneumatic and hydraulic components, etc.
   - Important units of measurement for installing the different types of power supplies.
   - Location of the current-carrying capacity of a conductor.
   - Location of the electrical standards for installing the electrical power circuit.
   - Calculation of nominal current based on power and voltage for a single-phase and three-phase circuit.
   - Method of locating the fluid flow rate and supply pressure.

2. Install the frame for the automated system.
   - Use of measuring instruments: square, level, tape measure, etc. (review of Competency 5).
   - Characteristics of the different types of anchors and installation method.
   - Verification and correction of foot adjustment (review of Competency 12).

3. Make the necessary components.
   - Interpretation of mechanical drawings (review of competencies 5 and 9).
   - Use of measuring instruments: vernier calliper, micrometer, etc. (review of competencies 4, 5 and 9).
   - Use of machine tools: drill, milling machine, lathe and brake (review of competencies 5 and 9).
   - Use of soldering equipment (review of Competency 6).

4. Install the mechanical components.
   - Interpretation of mechanical drawings (review of Competency 12).
   - Use of mechanical alignment methods for conveyor belts, pulleys, couplers, etc. (review of Competency 12).
   - Use of methods of adjusting tension and mechanical allowance: belt, chain, gear wheel (review of Competency 12).
   - Differentiation between bolts, nuts and other fasteners (review of Competency 5).

5. Install and connect the pneumatic components.
   - Distinction between the different pneumatic parts (review of Competency 13).
   - Interpretation of pneumatic and electropneumatic circuit diagrams; symbols, location of orifices, etc. (review of Competency 13).
   - Criteria for selecting pneumatic hoses (review of Competency 13).
   - Types of connectors (review of competencies 8 and 13).
   - Calculation of the force and speed of the actuators (review of Competency 13).
   - Criteria for a professional installation (review of competencies 8 and 13).
   - Means of fastening ducts (review of Competency 8).

6. Install and connect the hydraulic components.
    - Distinction between the different hydraulic parts (review of Competency 15).
    - Interpretation of hydraulic and electrohydraulic circuit diagrams: symbols, location of orifices, etc. (review of Competency 15).
    - Criteria for selecting hydraulic hoses (review of competencies 8 and 15).
    - Calculation of the force and speed of the actuators (review of Competency 15).
    - Fabrication of hydraulic hoses or tubes: bending and installation of connectors (review of Competency 8).
    - Types of hydraulic connectors (review of competencies 8 and 15).
    - Criteria for a professional installation (review of competencies 8 and 15).
    - Means of fastening ducts (review of Competency 8).

7. Install and connect the electrical components.
    - Distinction between the control and power parts of an electrical circuit (review of Competency 3).
    - Colour code, types and gauges of electrical conductors (review of Competency 3).
    - Purpose of shielded cables (review of Competency 16).
    - Methods of pulling conductors.
    - Methods of drilling electrical panels using die punches, step drills, etc.
    - Installation of electrical components: human-machine interface (HMI), indicators, etc.
    - Preparation and installation of conductors: cutting, stripping, installation of ferrules, tinning, etc. (review of competencies 3, 16 and 17).
    - Preparation and installation of cables: cutting, stripping, installation in connectors, fastening method, etc.
    - Finding information in electrical standards (review of competencies 3 and 14).

8. Upload the program or programs.
    - Distinction between the different types of communication systems and the necessary equipment
    - Methods of connecting to a network (review of Competency 18).
    - Modification of communication parameters on the computer or controller (review of Competency 18).

9. Start up the automated system.
    - Method of verifying oil levels (review of competencies 12, 13, 15 and 19).
    - Use of measuring instruments: multimeter, megohmmeter, thermometer, clamp-on ammeter, etc. (review of competencies 3, 14 and 19).
    - Method of checking for fluid leaks (review of Competency 19).
    - Criteria for selecting oils (review of competencies 12, 13, 15 and 19).
    - Electrical isolation test (review of competencies 14 and 19).
    - Adjustment of thermal overload relays in compliance with electrical standards (review of Competency 14).
    - Adjustment of hydraulic components: hydraulic pressure limiting device, hydraulic flow regulator, etc.
    - Adjustment of pneumatic components: air pressure regulator, air flow regulator, etc.
    - Importance of installing mechanical safety devices before testing.
    - Important points to verify before powering up.
    - Measuring instrument insulation categories (review of Competency 3).

10. Ensure the proper operation of the automated system.
    - Important measures to take when verifying the operation of the circuit.
    - Identification of signs of failure.
    - Possible solutions to problems.
    - Criteria for choosing the best solution.

11. Record the data.
    - Data to be recorded (e.g. on a work order).
    - Importance of recording the programming and electrical parameters measured (review of competencies 16, 17 and 19).
    - Use of digital tools (review of Competency 19).

12. Clean and tidy up.
    - Importance of carefully storing tools and measuring instruments.
    - Hazards related to poor organization of the work area.

Career Development	Code: 783111

Competency 22 Duration 15 hours Credit 1

Situational Competency

Statement of the Competency

Manage their career.

Elements of the Competency

- Gather information from organizations in the targeted field.
- Determine their career goals.
- Be familiar with the job search process.

Learning Context

Information Phase

- Learning about job opportunities in the field.
- Listing the work experience, aptitudes and skills required for the job they are interested in.
- Learning about the steps in a job search process.
- Learning about the tools used to apply for jobs.

Participation Phase

- Reflecting on their preferences and interest in various career paths.
- Evaluating their strengths and areas requiring improvement in real or simulated interviews with potential employers.
- Determining the aptitudes and skills likely to influence their career choice, based on prior experience, including during the training program.
- Producing tools to apply for a job or request a meeting with a potential employer.

Synthesis Phase

- Determining the measures to take to improve their performance when requesting an interview by phone and going for a job interview.

Instructional Guidelines

- Create an environment conducive to reflection.
- Facilitate exchanges of opinions.
- Encourage students to identify their preferences and interest in various career paths.
- Organize realistic learning situations.

Participation Criteria

Information Phase

- Learn about the topics covered.
- Make a list of the work experience, aptitudes and skills required for the job they are interested in.

Participation Phase

- Participate in the suggested activities.
- Make a list of potentially interesting jobs.
- Produce tools.

Synthesis Phase

- Make a list of their strengths and areas requiring improvement, as well as means of improvement.

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

- Potential jobs in the field.
- Consultation of employment centres, employment agencies, local newspapers, the Internet, etc.
- Steps in the job search process: identification of fields of interest, applying for a job, formal or informal interviews, follow-up, etc.
- Tools used to apply for a job: cover letter, business card, resumé, etc.

Participation Phase

- Reflection on their preferences and interest in certain career paths in the field: employee, self-employed worker, etc.
- Assessment of their strengths and weaknesses in meetings with potential employers.
- Attitudes to adopt in an interview: dress, language, etc.
- Telephone communication: introduction, protocol, tone of voice, level of language and politeness.
- Production of job search tools: cover letter, business card, resumé.
- Rules of writing.

Synthesis Phase

- Determination of their strengths and areas requiring improvement in terms of job search, as well as means of improvement.
- Self-assessment, comments gathered during the scenarios or workplace practicums, etc.

Entering the Workforce	Code: 783126

Competency 23 Duration 90 hours Credits 6

Situational Competency

Statement of the Competency

Enter the workforce.

Elements of the Competency

- Apply competencies acquired during the training process.
- Comply with the company's standards and practices.
- Consolidate attitudes compatible with the practice of the trade.
- Take stock of their learning.

Learning Context

Information Phase

- Learning about the terms and conditions for the practicum.
- Learning about the contents of a log.
- Learning about the rules and practices in the company offering the practicum.

Participation Phase

- Observing trade-related practices.
- Integrating into the work team.
- Performing a variety of trade-related tasks.
- Keeping a log.

Synthesis Phase

- Producing a report on their practicum experience.
- Presenting a summary of their practicum experience.

Instructional Guidelines

- Encourage students to share their points of view.
- Inform students in advance of the practicum's objectives.
- Agree with the practicum supervisors on ways of fostering the performance of trade-related tasks and the development of students' autonomy.
- Maintain close collaboration with the practicum supervisors.
- Make sure trainees are effectively supervised.
- Regularly visit the trainees in the company.
- Solve problems that arise during the practicum.
- Foster critical evaluation of the practicum.

Participation Criteria

Information Phase

- Learn about the topics covered.
- Participate in activities.

Participation Phase

- Perform or participate in the performance of the tasks assigned under the agreement.
- Keep a log.

Synthesis Phase

- Present a practicum report.
- Participate in the evaluation of their practicum.

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

- Terms and conditions, objectives and duration of the practicum, supervision, requirements, participation criteria, company rules.
- Log: headings, purpose, importance of recording the facts as they occur and connection to the practicum report.
- Identification of companies that meet their expectations and needs, as well as companies that have taken in student trainees in the past, and examination of those practicum experiences.
- Consultation of various sources.
- Procedure for obtaining a practicum position: communication with the employer, agreement on the terms and conditions of the practicum, presentation to the employer of a list of tasks students must perform in order to meet practicum requirements, confirmation of practicum, receipt of the necessary documents.

Participation Phase

- Integration into the work team: observation of and compliance with work methods, team meetings and informal meetings, teamwork, reception and transmission of information, acceptance of advice and comments, feedback, verification of the satisfaction of the practicum supervisors.
- Adoption of attitudes and behaviours conducive to a successful practicum.
- Qualities appreciated by employers.
- Attitudes conducive to making the most of the experience.
- Keeping a log.
- Useful and meaningful elements for the practicum report.
- Observations in the workplace: work context, tasks performed, application of work methods, etc.
- Introduction to new work methods or procedures.
- Recording of observations in the log.
- Performance of tasks: active participation in the practicum.
- Occupational health and safety rules.
- Instructions and company rules.
- Recording of tasks in the log.

Synthesis Phase

- Report on activities carried out during the practicum.
- Typical content of a practicum report:
  - Report on activities observed and performed on a daily basis
  - Procedures used or new technologies, new learning, new problems and solutions found, etc.
- Comments received about their performance of tasks.
- Use of the log.
- Evaluation of the practicum: criteria to consider
  - Self-evaluation
  - Report on their experience
  - Mention of positive elements and level of satisfaction
  - Mention of problems encountered and solutions found
  - Perception of the trade before and after the practicum
  - Use of the log.
- Comparison of the learning acquired during the program with the activities observed or performed in the workplace.
- Aspects of the trade that are consistent or inconsistent with their training with respect to the workplace, trade practices, job requirements, etc.

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