PROGRAM OF STUDY

Welding and Assembly (DVS 5882)

TRAINING SECTOR: METALLURGICAL TECHNOLOGY

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.

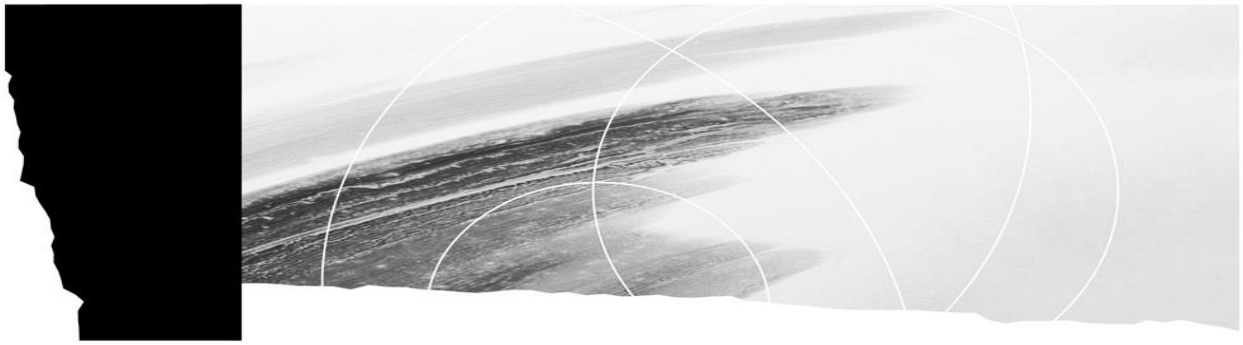
Aspects of Program Implementation

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 as 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.



5882	**Welding and Assembly**

Year of approval: 2021

Certification:	Diploma of Vocational Studies
Number of credits:	120
Number of competencies:	27
Total duration:	1800 hours

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

- Persons who hold a Secondary School Diploma or its recognized equivalent.

OR

- Persons who are at least 16 years of age on September 30 of the school year in which 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 and MTH-3053-2, or recognition of equivalent learning.

OR

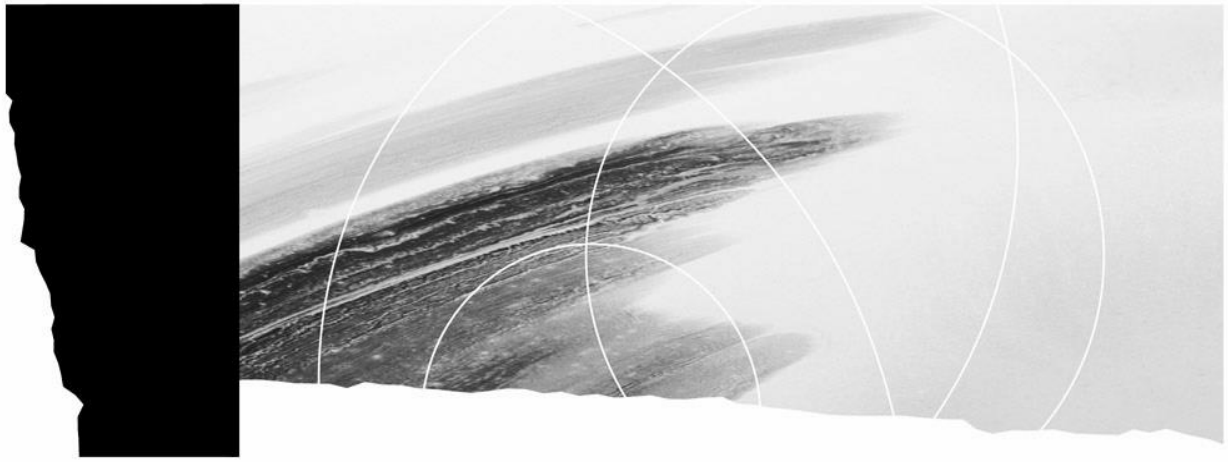
- Persons who have obtained Secondary III credits in language of instruction, second language and mathematics in programs established by the Minister are required to pursue, concurrently with their vocational training, Secondary Cycle Two general education courses in programs established by the Minister.

The duration of the program is 1800 hours, which includes 1260 hours spent on the specific competencies required to practise the trade or occupation and 540 hours on general, work-related competencies. The program of study is divided into 27 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	Hours	Credits
The Trade and the Training Process	804672	1	30	2
Health and Safety on Construction Sites	754992	2	30	2
Welding of Steel and Stainless Steel (GMAW) – Flat and Horizontal Positions	804687	3	105	7
Welding and Assembly Calculations	804692	4	30	2
Mechanical Cutting and Preparation	804703	5	45	3
Simple Assembly Drawings and Sketches	804716	6	90	6
Access, Lifting and Handling	804722	7	30	2
Thermal Cutting	804733	8	45	3
Welding of Steel (FCAW) – Flat and Horizontal Positions	804746	9	90	6
Bending and Shaping	804754	10	60	4
Welding of Steel and Stainless Steel (GMAW) - Vertical and Overhead Positions	804765	11	75	5
Drilling, Punching and Bolting	804772	12	30	2
Simple Assemblies	804785	13	75	5
Welding of Steel and Stainless Steel (SMAW) – Flat and Horizontal Positions	804795	14	75	5
Complex Assembly Drawings	804807	15	105	7
Structural Assemblies	804817	16	105	7
Welding and Cutting Procedures	804822	17	30	2
Welding of Steel (FCAW) – Vertical and Overhead Positions	804833	18	45	3
Welding – Automated and Robotic Systems	804845	19	75	5
Assemblies of Medium Complexity	804858	20	120	8
Welding of Steel and Stainless Steel (GTAW) – All Four Positions	804866	21	90	6
Welding of Steel (SMAW) – Vertical and Overhead Positions	804875	22	75	5
Welding of Aluminum (GMAW) – All Four Positions	804884	23	60	4
Welding of Aluminum (GTAW) – All Four Positions	804894	24	60	4
Complex Assemblies	804908	25	120	8
Career Development	804911	26	15	1
Entering the Work Force	804926	27	90	6



Part I

Program Goals

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Program Goals

The *Welding and Assembly* program prepares students to practise the trade of welder-assembler.

Welder-assemblers work mainly in factories that make a wide variety of metal products, such as machinery and equipment used for preparing food or extracting and processing ore, agricultural machinery and transportation equipment. They can also work in welding shops specializing in repairs.

Welder-assemblers prepare, assemble and weld metal parts (by applying heat and using filler metal or fusion welding techniques) in order to manufacture, repair or modify mechanically welded assemblies. They use welding set-ups and materials, as well as manual and semi-automatic welding processes.

Welding is a wide field that includes a range of possibilities with respect to the types of parts welded and the types of materials (e.g. mild steel, stainless steel, aluminum), welding processes (e.g. GMAW, GTAW, FCAW, SMAW), positions (flat, horizontal, vertical, overhead), cutting processes (e.g. oxy-fuel cutting, plasma arc cutting, cutting using shears), shaping processes (e.g. bending, shaping, grinding), etc. In addition, welder-assemblers are increasingly required to use automated or robotic manufacturing equipment.

Welder-assemblers should be relatively versatile when it comes to welding processes, materials and so on, although, given the wide variety of processes and materials, they cannot be proficient in all of them. However, the more versatile they are, the more employable they will be.

Welder-assemblers must also be able to focus, plan and resolve a variety of problems, which will allow them to identify welding problems and adjust the machines' settings accordingly. They must always be on the lookout for possible design problems and, in some cases, they can help improve manufacturing by collaborating with draftspersons, engineers, forepersons, etc. Lastly, they must always avoid compromising their health and safety and those of others.

The sectors of activity in which welder-assemblers work are subject to many laws, regulations and standards. These are incorporated into the drawings and welding procedures given to welders-assemblers.

With experience, and depending on the type of activity their employer is involved in, some welder-assemblers will develop specific expertise, in a given welding process, for example, and become valued resource persons.

The program goals of the *Welding and Assembly* 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 work force, 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 *Welding and Assembly* program is to help students develop attitudes and behaviours that representatives from education and the field deem essential to the practice of the trade or occupation:

- versatility, to be able to adapt to the different sectors, processes, parts and situations (manufacturing or repair)
- self-reliance, to be able to adjust machines, determine procedures, etc.
- constant verification of the quality of their work
- effective stress management, in particular during exams to qualify for welding processes or obtain certificates of competency

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.
- Weld steel and stainless steel using the GMAW process in the flat and horizontal positions.
- Perform welding and assembly calculations.
- Proceed with the mechanical cutting and preparation of metal parts.
- Interpret simple assembly drawings and draw sketches.
- Use access, lifting and handling equipment.
- Proceed with the thermal cutting of metal parts.
- Weld steel using the FCAW process in the flat and horizontal positions.
- Bend and shape metals.
- Weld steel and stainless steel using the GMAW process in the vertical and overhead positions.
- Drill, punch and bolt metals.
- Create simple assemblies.
- Weld steel and stainless steel using the SMAW process in the flat and horizontal positions.
- Interpret complex assembly drawings.
- Create structural assemblies.
- Establish welding and cutting procedures.
- Weld steel using the FCAW process in the vertical and overhead positions.
- Weld steel using automated and robotic systems.
- Produce assemblies of medium complexity.
- Weld steel and stainless steel using the GTAW process in all four positions.
- Weld steel using the SMAW process in the vertical and overhead positions.
- Weld aluminum using the GMAW process in all four positions.
- Weld aluminum using the GTAW process in all four positions.
- Produce complex assemblies.
- Manage their career.
- Enter the work force.

Grid of Competencies

The grid of competencies shows the relationship between general competencies, which correspond to professional 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

WELDING AND ASSEMBLY DVS 5882				GENERAL COMPETENCIES													WORK PROCESS				TOTAL
SPECIFIC COMPETENCIES	**Competency number**	**Type of competency**	**Duration (in hours)**	Determine their suitability for the trade and the training process	Prevent risks to health, safety and physical well-being on construction sites	Perform welding and assembly calculations	Proceed with the mechanical cutting and preparation of metal parts	Interpret assembly drawings and draw sketches	Use access, lifting and handling equipment	Proceed with the thermal cutting of metal parts	Bend and shape metals	Drill, punch and bolt metals	Interpret complex assembly drawings	Establish welding and cutting procedures	Manage their career	Learn about the job to be done	Prepare the work	Carry out the work	Finish the work	
Competency number				1	2	4	5	6	7	8	10	12	15	17	26					
Type of competency				S	S	B	B	B	B	B	B	B	B	B	S					
Duration (in hours)				30	30	30	45	90	30	45	60	30	105	30	15					540
Weld steel and stainless steel using the GMAW process in the flat and horizontal positions	3	B	105	○	●		○	○	○	○	○	○	○	○	○	▲	▲	▲	▲	
Weld steel using the FCAW process in the flat and horizontal positions	9	B	90	○	●	●	●	●	●	●	○	○	○	○	○	▲	▲	▲	▲	
Weld steel and stainless steel using the GMAW process in the vertical and overhead positions	11	B	75	○	●	●	●	●	●	●	○	○	○	○	○	▲	▲	▲	▲	
Create simple assemblies	13	B	75	○	●	●	●	●	●	●	●	○	○	○	○	▲	▲	▲	▲	
Weld steel and stainless steel using the SMAW process in the flat and horizontal positions	14	B	75	○	●	●	●	●	●	●	○	○	○	○	○	▲	▲	▲	▲	
Create structural assemblies	16	B	105	○	●	●	●	●	●	●	●	●	●	○	○	▲	▲	▲	▲	
Weld steel using the FCAW process in the vertical and overhead positions	18	B	45	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Weld steel using automated and robotic systems	19	B	75	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Produce assemblies of medium complexity	20	B	120	○	●	●	●	●	●	●	●	●	●	○	○	▲	▲	▲	▲	
Weld steel and stainless steel using the GTAW process in all four positions	21	B	90	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Weld steel using the SMAW process in the vertical and overhead positions	22	B	75	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Weld aluminum using the GMAW process in all four positions	23	B	60	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Weld aluminum using the GTAW process in all four positions	24	B	60	○	●	●	●	●	●	●	○	○	○	●	○	▲	▲	▲	▲	
Produce complex assemblies	25	B	120	○	●	●	●	●	●	●	●	●	●	●	○	▲	▲	▲	▲	
Enter the work force	27	S	90	○	○	○	○	○	○	○	○	○	○	○	○	△	△	△	△	
Total duration			1 260																	1 800

Links between the general competencies and the 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

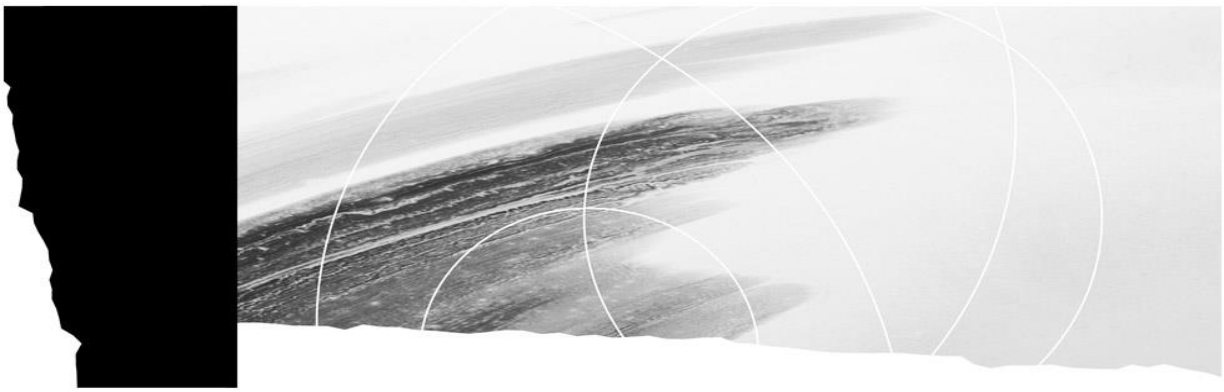
The Ministère de l'Éducation harmonizes its vocational and technical programs by establishing similarities and continuity between secondary- and college-level programs within a particular sector or between sectors in order to avoid overlap in program offerings, to recognize prior learning and to optimize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

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

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

An important aspect of harmonization is that it allows the common characteristics 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 *Welding and Assembly* 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 Soudage-assemblage.*



Part II

Program Competencies
Glossary

The Trade and the Training Process	Code: 804672

Competency 1 Duration 30 hours Credits 2

Situational Competency

Statement of the Competency

Determine their suitability for the trade and the training process.

Elements of the Competency

- Be familiar with the trade and the possibilities it offers.
- Understand the training process.
- Confirm their career choice.

Learning Context

Information Phase

- Learning about the job market in welding and assembly (workplaces, job prospects, remuneration and opportunities for advancement and transfer).
- Learning about the specifics of the trade and the nature and requirements of the job (e.g. tasks, working conditions).
- Learning about the skills, attitudes and knowledge required.
- Learning about the training process (program of study, evaluation methods and certification of studies).

Participation Phase

- Talking to welder-assemblers during visits to companies, presentations, etc.
- Discussing the data collected and their view of the trade.
- Discussing how the program of study relates to the actual work situation.
- Finding ways of fostering their academic success and integration into the job market.

Synthesis Phase

- Preparing a list of their aptitudes, preferences, skills, attitudes, strengths and areas requiring improvement in order to practise 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.
- Present students with a realistic vision of the trade through visits to companies, presentations, etc.
- Make the relevant documentation available.
- Provide students with the means to assess their career choice objectively.

Participation Criteria

Information Phase

- Gather information on the topics covered.

Participation Phase

- Express their views on the trade and the training process during a group discussion or with the teacher, relating them to the information they gathered.

Synthesis Phase

- Produce an oral or written report that:
  - sums up their preferences, interests and aptitudes
  - explains 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 the competency as a whole and to each phase of the learning context, along with their attendant guidelines.

For the competency as a whole

- Use of digital tools: operating system, web browsers and search engines, messaging, communication, etc.
- Basic digital operations: identifying themselves, navigating the operating system, finding information, creating and saving files and directories, etc.

Information Phase

- Location of information in reference documents (paper or digital) during visits or meetings or on the Internet: importance of information source.
- Note-taking method.
- Definition of the trade (e.g. tasks, operations).
- Laws, regulations, codes and standards governing the work of welder-assemblers.
- Fields of activity, hiring statistics, salaries, etc.
- Skills sought by employers.
- Code of conduct and requirements of the educational institution.
- Training process, scope of the trade and versatility.
- Contents of the program of study and information about evaluation for certification purposes.

Participation Phase

- Data to record when visiting a workplace, listening to a presentation, etc.
- Method of organizing and presenting data.
- Advantages of sharing their point of view and taking others' points of view into account.
- Rules of communication during group discussions: ability to listen, respect for each person's right to speak, ability to stick to the topic, ability to pay attention to others, openness to different points of view, etc.
- Development of an attitude of openness to constructive comments.

Synthesis Phase

- Definition of expectations.
- Preferences with regard to the field of application and the tasks performed.
- Reasons justifying their career choice, their view of the trade and the means available to practise it.
- Main elements of a report (oral or written) confirming their career choice: summary of their preferences, aptitudes and interests and the requirements of the trade; comparison of their preferences, aptitudes and interests 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 standards and regulations.
- Recognize dangerous situations or hazardous behaviours and the applicable preventive measures.

Learning Context

Information Phase

- Learning about the risks inherent in construction sites.
- Learning about the standards and regulations 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

- Participating in situations in which risks must be prevented and dangers eliminated with respect to the environment, facilities, equipment and machinery, materials and tools, energy sources, etc.
- Participating in activities allowing them to recognize the risks related to 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 hazardous 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
  - goals and means of improvement.

Instructional Guidelines

- Provide the necessary information sources.
- If applicable, invite resource persons specializing in certain aspects of occupational health and safety.
- 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 students in their self-assessment by providing them with the tools they need (e.g. questionnaire) to analyze their experience and set personal goals.

Participation Criteria

Information Phase

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

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 the competency as a whole and to each phase of the learning context, along with their attendant guidelines.

Information Phase

- Importance of information about health and safety on construction sites.
- Most common risks to health, safety and physical well-being on construction sites.
- Sources of information about health and safety on construction sites and information searches.
- Roles and responsibilities related to health and safety on construction sites.
- Health and safety regulatory framework.
- Advantages of complying with health and safety rules.
- Prevention of illness and accidents.

Participation and Synthesis Phases

- 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 materials.

Welding of Steel and Stainless Steel (GMAW) – Flat and Horizontal Positions	Code:	804687

Competency 3 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Weld steel and stainless steel using the GMAW process in the flat and horizontal positions.

Achievement Context

- Making welds with and without stops and restarts.
- Given:
  - steel and stainless steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - oral and written instructions
  - photographs and simple drawings
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - a GMAW welding set-up
  - a work table
  - tools and equipment
  - shielding gases
  - different types and diameters of electrode wires
  - a rotary positioner

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – photographs and simple drawings – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Careful choice of welding set-up. • Careful choice of wire feeder. • Proper preparation of joints to be welded. • Proper installation of electrode wire. • Proper installation of shielding-gas supply system. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts.

3. Make welds: • full and partial penetration welds on all basic joints on steel. • partial penetration welds on fillet joints on stainless steel.	• Proper adjustment of welding parameters. • Appropriate use of the different transfer. modes in electric arc welding: short circuit, globular and spray. • Appropriate use of rotary positioner. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts and blowouts • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with photographs, drawings, etc. • Compliance with welding procedures. • Compliance with manufacturers' recommendations. • Proper choice and use of tools and equipment. • Use of an appropriate method of reducing welding distortion.

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:

- Welding of steel, e.g. parts 1 to 10 mm thick.
- Welding of stainless steel, e.g. parts 1 to 4 mm thick.
- Hazards associated with GMAW welding set-ups, accessories, products, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used.
- Operation of the extraction system for welding gases and fumes.

- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters).
- Personal and collective protective measures against burns caused by arc rays, hot parts and weld spatter.
- Storage, transportation and installation of gas cylinders.
- Terminology used in the classification of steel: mild, low-alloy, alloy, stainless, etc.
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc.
- Expansion and contraction.
- Specific characteristics of GMAW welding set-ups depending on the manufacturer
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc.
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 1F, 2F, 1G, 2G, etc.
- Identification of defective couplers or welding cables.
- Detection of shielding gas leaks.

1. Learn about the job to be done.
   - Zones and different steps in the work process.
   - Interpretation of welding procedures: type of joint, welding position of joint, filler metals, arrangement of weld beads, welding parameters, etc.
   - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, electrode wires).
   - Sequence of operations and importance of compliance with checkpoints.
   - Shapes and sizes of the different types of steel and stainless steel products, e.g. plates, structural shapes.
   - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups.
   - Strategies for finding information in paper and digital documents.
   - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
   - Criteria for choosing welding set-up components and installation method.
   - Criteria for choosing the electrode wire based on the procedure.
   - Cleaning of plates (e.g. oxidation, dirt).
   - Preparation of work area.
   - Use of method for adjusting basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
   - Method of tack welding the assembly to reduce distortion.
   - Arrangement of welding equipment to allow for fluid welding movement.
   - Positioning of assembly to facilitate welding.
   - Method of selecting a GMAW welding set-up.
   - Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size).
   - Gas mix used for welding steel using the GMAW process.
   - Effect of gases and gas mixes on the type of filler metal transfer in the electric arc and the weld bead, for example, pure CO_2, argon/CO_2 mix or argon/oxygen mix.
   - Methods of installing the welding spool, gas supply, pressure regulator with flowmeter, welding gun and accessories, etc.
   - Methods of adjusting welding set-up components (adjustment of contact tip, nozzle, wire guide, etc.)
   - Methods of adjusting welding set-up parameters (e.g. wire-feed speed, voltage).
   - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper adjustment of parts.

3. Make welds.
    - Characteristics of a quality weld bead: dimensions, profile, buildup, wetting.
    - Method of adjusting a GMAW welding set-up: wire speed, voltage, terminal length, arc length, etc.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 25% for the width, 20% for the height and 3 mm for the straightness of the bead.
    - Welding position ensuring stability throughout the process.
    - Method of obtaining quality arc strikes.
    - Distinction among the different transfer modes: short circuit, globular and spray.
    - Welding methods, e.g. push, pull, travel angle, oscillatory motion of the welding gun, travel speed.
    - Method of welding at joint stops and starts.
    - Single-bead and multiple-bead welding methods.
    - Welding methods to perform a full penetration pass on a butt joint preparation with gap.
    - Effects of different welding sequences on the distortion of parts and assemblies.
    - Importance of welding along the entire length of the joint: beginning and end of joint correctly welded.
    - Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, etc.
    - Measurement of welds using a welding gauge.
    - Visual detection of the different welding defects.
    - Causes of the main welding defects.
    - Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
    - Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc.
    - Methods of preparing fillet welding samples for a destructive test in accordance with Canadian standards.

4. Finish the job.
    - Shutdown of welding set-up and other equipment, disconnection of power source, etc.
    - Method of cleaning welding set-up components (e.g. gun nozzle, welding gun conduit liner) and the work area.
    - Storage of equipment in the designated places.

Welding and Assembly Calculations	Code: 804692

Competency 4 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

Perform welding and assembly calculations.

Achievement Context

- Given:
  - representations of simple parts (e.g. photographs, images)
  - simple material lists
- Using:
  - a scientific calculator (standard calculator or computer application)
  - rulers
  - protractors
  - unit conversion tables, etc.

Elements of the Competency	Performance Criteria
1. Choose the calculations to perform.	• Appropriate choice of formulas. • Accurate determination of sequence of operations.
2. Convert units of measurement.	• Appropriate use of conversion tables. • Accurate conversion of units.
3. Calculate lengths, areas and volumes.	• Accurate calculation of: – length, area and volume of parts – volumes of gas • Consideration of slope and angle.
4. Calculate the position of geometric shapes.	• Accurate calculation of the position of geometric shapes. • Consideration of slope and angle.
5. Calculate the cost of raw materials.	• Accurate calculation of cost plus tax for a given: – weight – linear measurement – area
	For the competency as a whole:
	• Appropriate choice of information needed for the calculations. • Proper application of formulas. • Thorough verification of results. • Observance of tolerances. • Proper use of scientific calculator (standard calculator or computer application).

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 the basic functions of a scientific calculator: exponent, square root, sine, cosine, tangent, etc.
- Solving of simple arithmetic equations: addition, subtraction, multiplication, division, etc.
- Calculation of exponents, square roots, etc.
- Characteristics of first-degree equations with one variable.
- Method of isolating a variable.
- Types of formulas used to calculate dimensions, positions, etc.
- Identification of relevant data for the calculations: unit, radius, diameter, interior or exterior angle, etc.

1. Choose the calculations to perform.
   - Units of measurement used in welding: inches, feet, millimetres, centimetres, metres, square feet, square metres, cubic feet, cubic metres, litres per minute, cubic feet per hour, etc.
   - Factors determining the sequence of operations.
   - Basic geometry terminology: acute angle, obtuse angle, right angle, radius, diameter, etc.
   - Characteristics of the basic geometric shapes: lines (perpendicular, parallel and tangent), squares, rectangles, triangles, polygons, etc.

2. Convert units of measurement.
   - Usefulness of converting units of measurement in welding and assembly.
   - Application of the rule of three.
   - Conversion (imperial and metric systems) of units of:
     - length (e.g. millimetre, centimetre, metre, inch, foot)
     - area (e.g. square metre, square foot)
     - volume (e.g. litre, cubic metre, cubic foot)
     - weight (e.g. pound, gram, kilogram, imperial ton, metric tonne)
     - weight per volume (e.g. grams per cubic centimetre, pounds per cubic inch)
     - speed (e.g. metres per minute, inches per minute)
     - weight per length (e.g. grams per inch, pounds per metre)
     - weight per area (e.g. pounds per square inch, grams per square metre)
     - flow: cubic feet per hour to litres per minute, and vice versa
     - length per amount of time (e.g. for converting wire-feed speed): inches per minute into metres per minute or millimetres per minute, and vice versa
   - Method of using conversion tables for plates and structural shapes.

3. Calculate lengths, areas and volumes.
   - Use of the constant pi (π).
   - Calculation of lengths, areas and volumes of different-shaped parts (e.g. square, rectangular, triangular, circular, polygonal).
   - Calculation of a volume of gas (e.g. to determine the volume of gas or amount of time needed to purge a standard tank).
   - Calculation of the number of parts that can be cut to a given length or area (e.g. based on the length of the sides of a right triangle or the length of standard metal profiles).
   - Calculation of the dimensions of a standard shape using the Pythagorean theorem.
   - Conversion of slope to degrees, and vice versa.
   - Calculation of the rake angle of a part.

- Addition and subtraction of degrees to adjust a rake angle.
- Types of formulas for calculating geometric shapes.
- Calculation methods for plane geometry.
- Calculation methods for trigonometry: Pythagorean theorem, sine, cosine, tangent, sine law.
- Methods of calculating missing dimensions, missing angles, and the location dimension of the hole centres on a bolt circle.

4. Calculate the position of geometric shapes.
   - Calculation of the distance between geometric shapes using different units of measurement.
   - Calculation of the position of different geometric shapes (square, rectangle, triangle and circle) with respect to the edge, centre and angles of a part.
   - Calculation of the position of a hole: position of hole with respect to the edge of the part, another hole, etc.
   - Calculation of the position of a part based on an angle or slope.
   - Determination of the position of parts or holes that are equidistant over a given length or area.

5. Calculate the cost of raw materials.
   - Calculation of the amount of raw materials based on a simple material list.
   - Calculation of the cost of raw materials according to the amounts determined based on a simple material list.
   - Search for the cost of an item in a table of standard products.
   - Production of a simple invoice.
   - Calculation of the cost per unit of length or area: dollars per linear or square metre, dollars per linear or square foot, etc.
   - Calculation of provincial and federal taxes.

Mechanical Cutting and Preparation	Code: 804703

Competency 5 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Proceed with the mechanical cutting and preparation of metal parts.

Achievement Context

- Given:
  - oral and written instructions
  - manuals for mechanical cutting and preparation equipment
  - photographs, drawings, etc.
  - steel, stainless steel, aluminum and other metal plates and structural shapes of different thicknesses, both regular and irregular in shape
  - steel, stainless steel, aluminum and other metal parts
- Using:
  - personal and collective protective measures
  - a hydraulic shear
  - combination snips
  - a portable electric shear
  - a mechanical bevelling machine
  - a band saw
  - an abrasive saw
  - a portable grinder
  - a pedestal grinder
  - manual tools

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Determination of an efficient sequence of operations. • Careful choice between marking and adjusting stops. • Economical use of materials. • Precise marking of parts or adjustment of stops. • Proper use of marking pattern if applicable.
2. Cut, bevel and notch metal parts.	• Precise adjustment of settings. • Proper positioning of parts. • Solid fastening of parts. • Appropriate use of cutting fluid. • Clean and precise cut.

3. Clean and deburr metal parts.	• Proper deburring of parts. • Cleanliness of parts.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Proper choice and use of materials, tools and equipment. • Harmonious and effective communication. • Thorough verification of the work done.

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:

- Hazards associated with mechanical cutting and preparation, accessories, equipment, etc.
- Data sheets for the different hazardous products used.
- Method of obtaining clean cuts with different cutting equipment.
- Adjustment and installation of different portable cutting-tool components: angle grinder, band saw, etc.
- Method of using different cutting equipment: band saw, portable shear, etc.
- Method of using different grinding and finishing equipment: portable grinder with different abrasive discs.
- Work areas and sequence of operations.
- Instructions concerning the equipment used, the type of cut, measurements, tolerances and handling.
- Sequence of operations and checkpoints.
- Composition of different metals: steel, stainless steel, aluminum, etc.
- Classification and storage of metal products.
- Shape and dimensions of plates, bars, angle irons, tubes, expanded metal and gratings, etc.
- Types of finishes: hot and cold rolled, galvanized, brushed.
- Importance of taking the direction of rolling into account.
- Importance of good communication with co-workers and superiors.
- Methods of maintaining healthy communication and using the proper communication channel.

1. Prepare the work.
   - Method of planning the cuts to save time and materials.
   - Method of making a marking pattern.
   - Marking tools: carpenter’s square, combination square, pencil compass, dividers, beam compass, scriber, chalk, marker, etc.
   - Measuring tools: tape measure, ruler, checking template, vernier and micrometer.
   - Positioning of marking to save material.

2. Cut, bevel and notch metal parts.
    - Adjustment of settings: numerically controlled shear, combination snips, band saw, etc.
    - Method of preparing cutting fluid.
    - Installation of a cutting template on a shear.
    - Positioning of plates and structural shapes.
    - Fastening of parts using vises, clamps and locking pliers.
    - Operation of mechanical equipment and safety instructions.
    - Straight, curved, angular and circular cuts.
    - Cuts using positioning stops.
    - Handling of a portable bevelling machine.
    - Instruments to verify the cut: tape measure, square, template, etc.
    - Instruments to verify the thickness of the material: thickness gauge, vernier calliper, micrometer.
    - Method of handling verification instruments.
    - Types of defects: cutting and preparing (burrs, twisting, distortion, stretching, marks), dimensional, geometric, angular, directional.
    - Methods of correcting defects.

3. Clean and deburr metal parts.
    - Cleaning aimed at removing all traces of filings, dust, marks, distortion, cutting fluid, etc.
    - Choice of cleaning method: file, chisel, brush, grinder, etc.
    - Method of using a deburring tool, file, brush, grinder, etc.
    - Choice of abrasive disc for adequate cleaning.
    - Method of using an abrasive disc to avoid marks and distortion.

Simple Assembly Drawings and Sketches	Code: 804716

Competency 6 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency

Interpret simple assembly drawings and draw sketches.

Achievement Context

- Given:
  - oral or written instructions
  - simple assembly drawings in isometric and orthographic (American and European) projection
- Using:
  - digital tools
  - technical drawings
  - graph paper
  - isometric paper
  - catalogues of metal product manufacturers

Elements of the Competency	Performance Criteria
1. Interpret the projections and views used in a simple assembly drawing.	• Correct interpretation of the different types of lines. • Accurate determination of the type of projection used. • Proper distinction among the different views used. • Accurate association of data between the different views represented.
2. Interpret the dimensions and notes used in a simple assembly drawing.	• Accurate interpretation of: – shape and position values – dimensional tolerances – general and local notes – material list
3. Interpret simple welding symbols.	• Accurate interpretation of simple welding symbols: – basic symbols – preparation symbols – welding symbols – finishing symbols
4. Draw a freehand sketch of a simple assembly.	• Precision of sketch. • Presence of all the data needed to manufacture parts or produce a simple assembly. • Accurate dimensioning of data. • Correspondence between the views.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with oral or written instructions.
- Clarity and precision of sketches.
- Accurate arrangement of views.
- Accurate conversion of units of measurement.
- Thorough verification of the accuracy of the data.

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:

- Types of pencils used in technical drawing: HB, 2H, 4H.
- Types and formats of paper used in technical drawing: A4, A3, A2, A1, A0, A, B, C, D, E.
- Units of measurement used in technical drawings, and conversion of units from the international to the imperial system and vice versa (review of Competency 4).
- Arrangement of data on a technical drawing.
- Standard method of folding a drawing.
- Strategies for finding information in paper and digital documents.
- Basic functions needed to view digital technical drawings.

1. Interpret the projections and views used in a simple assembly drawing.
   - Meaning of the different types of lines: contour, hidden, centre, phantom, extension, dimension, section, short break, long break.
   - Types of projections:
     - isometric
     - American orthographic
     - European orthographic
   - Symbols in American or European projections.
   - Types of views: six basic views, auxiliary views and sectional views.
   - Method of associating data in:
     - basic views
     - basic and auxiliary views
     - sectional views
   - Distinction among the three main views: front view, right-side view and drawing view.
   - Positioning of basic views: correlation between basic views in American and European projections.
   - Difference between an isometric view and a perspective view.
   - Identification of sectional views: full section, short break, long break, partial section.
   - Types of hatching used in drawings of mechanically welded assemblies: steel, cast iron, aluminum.
   - Distinction between auxiliary and symmetrical views.
   - Positioning of auxiliary and symmetrical views.
   - References between the drawing and the actual part.

- Material list: identification of parts, types of materials, shapes, dimensions and quantity.
- Information contained in the title block: identification of drawing, name of draftsperson, production date, revision date.
- Imperial and international systems of measurement (review of Competency 4).
- Angles in degrees, angles in length/height ratio (slope).

2. Interpret the dimensions and notes used in a simple assembly drawing.

- Distinction among the different extension lines: lines and positions for cross sections, arcs, etc.
- Distinction among the different dimensioning lines: lines or arrows used, position of dimensions, origins, etc.
- Distinction between shape and position values: location, overlapping of several values.
- Dimension-related symbols: dimension lines, arrows and symbols for diameters, radii, slopes, degrees, notes, etc.
- Dimensions from the origin.
- General and local tolerances for a length and an angle.
- Bidirectional and unidirectional tolerances.
- General notes: manufacturing details, specific characteristics of a part or assembly, etc.
- Local notes: hole details, finishing details, etc.
- Distinction among the different parts of a simple material list: identification of parts, shapes, dimensions, types of materials, quantity, etc.

3. Interpret simple welding symbols.

- Simple welding symbols on a surface to be machined.
- Basic symbols: reference lines, arrows, tails.
- Preparation symbols and dimensions: straight butt, bevelled butt, fillet, etc.
- Welding symbols and dimensions: butt joint, bevel joint, fillet, etc.
- Welding contour symbols and finishing method.

4. Draw a freehand sketch of a simple assembly.

- Production of a sketch of a weld based on a welding symbol.
- Best front views of an object.
- Views needed to see all the details of an object.
- Standard sketch lines: solid, dashed, centre, phantom, extension, dimension, annotation, etc.
- Alignment and arrangement of views: transfer of information from the front view to the side view, from the front view to the top view, from the top view to the side view, etc.
- Types of holes: plain, threaded, oblong, etc.
- Common geometric shapes: circles, arcs, etc.
- Dimensioning of sketches: extension, dimension and annotation lines.
- Importance of indicating all manufacturing details for a part or component or of specifying the special characteristics of an assembly.

Access, Lifting and Handling	Code: 804722

Competency 7 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

Use access, lifting and handling equipment.

Achievement Context

- Given written or oral instructions.
- Using:
  - personal and collective protective measures
  - access, lifting and handling tools, equipment and accessories
  - reference documents
  - load capacity charts

Elements of the Competency	Performance Criteria
1. Install and use ladders and stepladders.	• Appropriate choice of ladder or stepladder depending on the job. • Careful inspection of the ladder or stepladder chosen. • Proper installation of ladder or stepladder. • Safe use of ladders and stepladders.
2. Install and use metal frame scaffolding.	• Thorough inspection of scaffolding and accessories. • Appropriate assembly sequence. • Appropriate use of scaffolding. • Appropriate disassembly sequence.
3. Lift and move loads using jib cranes, motorized winches, chain hoists, shop hoists, pallet trucks, skids, etc.	• Correct estimate of the weight of the load. • Correct determination of centre of gravity. • Careful choice of lifting devices and accessories. • Thorough inspection of lifting equipment and accessories. • Planning of moves adapted to the characteristics of the environment. • Appropriate positioning of lifting accessories based on the centre of gravity. • Appropriate lifting and moving of load. • Absence of damage to the object being moved and the surrounding objects.

4. Lift and move loads manually.	• Correct estimate of the weight of the load. • Planning of moves adapted to the characteristics of the environment. • Appropriate marking off of work area. • Appropriate vertical and horizontal movements. • Absence of damage to the object being moved and the surrounding objects. *For the competency as a whole:* • Compliance with occupational health and safety rules. • Compliance with instructions. • Compliance with current laws, regulations, codes and standards. • Correct determination of sequence of operations. • Harmonious and effective communication. • Appropriate storage of 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, lifting and handling.
- Marking off of work area.
- Inspection, use, maintenance and storage of personal and collective protective measures.
- Regulations respecting scaffolding, lifting and handling.
- Aspects to verify when planning lifting and moving operations.
- Importance of good communication.
- Methods of maintaining healthy communication and using the proper communication channel.

1. Install and use ladders and stepladders.
   - Inspection of equipment: compliance criteria.
   - Materials from which ladders and step ladders are made, and their characteristics.
   - Ladder and stepladder grades.
   - Methods of installing and using ladders and stepladders.
   - Risks related to the installation and use of ladders and stepladders, and preventive measures.
   - Risks related to working at heights, and preventive measures.

2. Install and use metal frame scaffolding.
   - Scaffolding components and their functions, limitations, etc.
   - Methods of installing and using metal frame scaffolding up to three sections high.
   - Inspection, adjustment and use of a safety harness.
   - Risks related to the installation and use of scaffolding, and preventive measures.
   - Risks related to working at heights, and preventive measures.

3. Lift and move loads using jib cranes, motorized winches, chain hoists, shop hoists, pallet trucks, skids, etc.
    - Location of weight on a piece of equipment.
    - Reading of identification plates on equipment.
    - Location of maximum capacity on identification plates of the equipment and accessory labels.
    - Criteria for choosing lifting and handling methods.
    - Application of mathematical formulas to calculate volumes in order to determine the equipment's mass.
    - Use of load capacity charts.
    - Conversion of imperial to international units of measurement and vice versa (review of Competency 4).
    - Uses of basket slings, eye slings and vertical slings.
    - Materials used to make slings and their characteristics.

4. Lift and move loads manually.
    - Manual handling methods requiring one or more people.
    - Importance of positioning and ergonomics during manual handling.
    - Risk factors associated with manual handling, and preventive measures.

Thermal Cutting	Code: 804733

Competency 8 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Proceed with the thermal cutting of metal parts.

Achievement Context

- Given:
  - oral and written instructions
  - technical drawings
  - metal parts made up of steel, stainless steel and aluminum plates, structural shapes, sheets, pipes, etc.
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - oxy-fuel cutting (OFC) set-ups
  - plasma arc cutting (PAC) set-ups
  - air carbon arc cutting set-ups (CAC)
  - tools and equipment

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate interpretation of instructions. • Careful choices for cutting and gouging: – tools and accessories – gases – power sources • Proper implementation of personal and collective protective measures.
2. Mark the parts to be cut by hand.	• Careful choice of marking instruments. • Careful choice of method for marking common geometric shapes. • Proper use of cutting pattern. • Precise, detailed marking.
3. Make straight, curvilinear and angular cuts by hand using the OFC and PAC processes.	• Compliance with procedure for starting up and shutting down cutting set-ups. • Proper adjustment of cutting parameters based on the metal to be cut. • Observance of cutting dimensions. • Compliance with required quality of cut. • Observance of cutting method that starts: – in the middle of the sheet – at the edge of the part

4. Make bevels.	• Proper adjustment of cutting parameters for bevelling. • Compliance with bevel angles. • Compliance with the required dimensions. • Quality of cuts.
5. Perform gouging operations using the CAC and PAC processes.	• Careful choice and proper assembly of gouging components. • Proper adjustment of cutting parameters. • Compliance with dimensions of gouging grooves. • Quality of gouging: regular depth and width.
6. Perform cutting operations using the numerically controlled PAC process.	• Settings in accordance with data in a numerically controlled cutting software program. • Accurate adjustment of cutting components. • Accurate positioning of parts on the cutting table. • Arrangement of cuts to conserve materials.
7. Verify the quality of the cuts.	• Accurate verification of the dimensions of the cuts. • Correct verification of the quality of the cuts. • Thorough inspection for cutting defects. • Careful choice of measures to correct the defects identified.
8. Clean the cuts.	• Careful choice of cleaning tools based on the required quality of cut and the type of metal. • Compliance with required finishing quality.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Appropriate use of measuring and marking instruments. • Appropriate inspection of equipment and accessories. • Appropriate work posture. • Precise marking of cutting lines. • Precise cuts. • Compliance with work methods. • Compliance with manufacturers' recommendations. • Harmonious and effective communication.

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:

- Hazards associated with thermal cutting, accessories, equipment, etc.
- Data sheets for the different hazardous products used.
- Distinction among the different thermal cutting processes: manual and mechanical OFC, manual and numerically controlled PAC, and CAC.
- Detection of defective cutting equipment components (hoses, couplers, safety devices, etc.)
- Proper replacement of damaged cables, hoses and accessories.
- Handling and storage of gases.
- Positioning of fume exhaust system.
- Increased risk due to the large amount of fumes from cutting and gouging.
- Use of spark arresters, protective shields and collective protective measures.
- Importance of good communication.
- Methods of maintaining healthy communication and using the proper communication channel.

1. Prepare the work.
   - Instructions related to the types of cuts and measurements, tolerances, etc.
   - Choice of tools and accessories based on the type of metal, its availability, location, position, thickness, etc.
   - Cleaning of cutting nozzles using the appropriate product.
   - Personal and collective protective measures: glasses, mask, visor, gloves, welder's jacket, protective shield, fume collector, etc.

2. Mark the parts to be cut by hand.
   - Measuring instruments: tape measure, ruler, square, protractor, marking template, etc.
   - Marking instruments: pencil, marker, scriber, centre punch, chalk, etc.
   - Common geometric shapes in welding and assembly: circle, arc, rectangle, triangle, irregular shape, etc.
   - Use of marking pattern.

3. Make straight, curvilinear and angular cuts by hand using the OFC and PAC processes.
   - Principle of oxy-fuel cutting.
   - Principle of PAC.
   - Combustible gases: propylene, propane, acetylene, etc.
   - Oxidizing gases: air and oxygen.
   - Adjustment of settings for the oxy-fuel cutting process: thickness of metal and size of nozzle, pressure.
   - Adjustment of settings for the PAC process: type of expansion nozzle, intensity of current, cutting gas.
   - Positioning of plates and structural shapes, and use of cutting table, vises, clamps and self-locking pliers.
   - Positioning of the components of a mobile or stationary oxy-fuel cutting set-up: trolley, cylinders, pressure-reducing valve, hoses, flame arrester, gas-check valve, torch, nozzle, compass guide, etc.
   - Positioning of the components of a PAC set-up: pressure-reducing valve, hoses, torch hose packs, plasma torch, nozzle, expansion nozzle, diffuser, electrode, compass guide, etc.

- Methods of cutting freehand and using a cutting guide.
- Cutting defects and corrective measures.

4. Make bevels.
   - Measurement of cutting angle using a protractor.
   - Methods of cutting freehand and using a cutting guide and mechanized trolley.
   - Positioning of rail on the part to be cut.
   - Positioning of mechanized trolley components: hoses, torch, flame arrester.
   - Adjustment of cutting torch on the mechanized cutting trolley: movement of torch from left to right and up and down, cutting speed and distance between the nozzle and the plate.
   - Bevelling defects and corrective measures.

5. Perform gouging operations using the CAC and PAC processes.
   - Principle of gouging with a CAC carbon electrode.
   - Components of a CAC gouging set-up.
   - Positioning of the components of an air carbon arc gouging set-up: source of constant or voltage current, cables, hoses, pressure-reducing valve, ground clamps, gouging handle, carbon electrode.
   - Shapes of carbon electrodes for the CAC process: flat and round, dimensions.
   - Adjustment of settings for the CAC gouging process: electrode diameter depending on the job, intensity of current and voltage, polarity, air flow, etc.
   - Principle of gouging using the PAC process.
   - Adjustment of settings for the PAC process: type of expansion nozzle, gas pressure, intensity of current, etc.
   - Distinction among the different components needed for PAC gouging (expansion nozzle, electrode, nozzle, diffuser) and their positioning.
   - Method of gouging to make a precision cut and avoid injury.
   - Gouging defects and corrective measures.

6. Perform cutting operations using the numerically controlled PAC process.
   - Components of a PAC system: numerically controlled table, cutting table, cutting set-up and torch, software, fume exhaust system.
   - Internet connection, USB key, etc.
   - Numerically controlled cutting software.
   - Cutting defects and corrective measures.

7. Verify the quality of the cuts.
   - Criteria for determining the quality of cuts.
   - Verification of the information on a drawing.
   - Dimensional, positioning and geometric tolerances.
   - Measuring instruments: tape measure, ruler, protractor, checking template, etc.
   - Cutting defects and corrective measures.

8. Clean the cuts.
   - Hand tools: metal brush, chipping hammer, chisel, file.
   - Power tools: portable grinder, portable sander, pedestal grinder, etc.

Welding of Steel (FCAW) – Flat and Horizontal Positions	Code: 804746

Competency 9 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency

Weld steel using the FCAW process in the flat and horizontal positions.

Achievement Context

- Making welds with and without restarts.
- Given:
  - steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an FCAW welding set-up
  - a work table
  - tools and equipment
  - shielding gases
  - different types and diameters of electrode wires
  - a rotary positioner

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
Prepare the work.	• Careful choice and proper installation of the components of a FCAW welding set-up. • Proper installation of electrode wire. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.

2. Prepare the work.	• Careful choice and proper installation of the components of a FCAW welding set-up. • Proper installation of electrode wire. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
3. Make welds: • partial penetration on all basic joints. • full penetration on butt and corner joints.	• Proper adjustment of welding parameters. • Appropriate use of rotary positioner. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – proper fusion – profile – presence of undercuts or blowouts – slag inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with welding procedures. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Appropriate use of weld gauge. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 3 to 20 mm thick.
- Hazards associated with FCAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used.
- Operation of the extraction system for welding gases and fumes (review of Competency 3).
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review of competency 3).
- Specific characteristics of FCAW welding set-ups depending on the manufacturer.
- Terminology used in the classification of steel: mild, low-alloy, alloy, etc. (review of Competency 3).
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc.
- Characteristics of steel and stainless steel electrode wires: dimension, classification, etc.
- Basic characteristics of gases and gas mixes: argon, CO_2, etc.
- Expansion and contraction of steel and other metals.
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 3).
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 1F, 2F, 1G, 2G, etc. (review of Competency 3).
- Identification of defective couplers or welding cables (review of Competency 3).
- Detection of shielding gas leaks (review of Competency 3).

1. Learn about the job to be done.
    - Zones and different steps in the process.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, electrode wires).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and sizes of the different types of steel products, e.g. plates, structural shapes (review of competencies 3, 5 and 8).
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups.
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc. (review of Competency 3).

2. Prepare the work.
    - Criteria for choosing welding set-up components (constant current and voltage sensing wire feeder, constant voltage and constant-speed wire feeder) and installation methods.
    - Characteristics of flux-cored wire, rutile flux wire, basic flux wire, metal core wire and self-shielding wire.
    - Criteria for choosing the electrode wire based on the procedure.
    - Cleaning of plates and welds to be repaired (e.g. oxidation, dirt).

- Preparation of work area (review of Competency 3).
- Use of method for adjusting basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints) (review of Competency 3).
- Method of tack welding the assembly to reduce distortion.
- Arrangement of welding equipment to allow for fluid welding movement (review of Competency 3).
- Positioning of assembly to facilitate welding.
- Method of selecting an FCAW welding set-up: power, arc time factor, etc.
- Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size).
- Gas mix used for welding steel using the FCAW process.
- Influence of gas mix on the type of filler metal transfer and on the weld bead.
- Methods of installing the welding spool, gas cylinder, pressure regulator with flowmeter, welding gun and accessories, etc.
- Methods of adjusting welding set-up components and parameters.
- Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper fit-up of parts (review of Competency 3).
- Means of removing a defective weld by CAC and PAC gouging, grinding, etc.
- Width and depth necessary for proper preparation (review of competencies 5 and 8).
- Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc.

3. Make welds.

- Characteristics of a quality weld bead: profile, buildup, wetting, etc.
- Method of adjusting an FCAW welding set-up: wire speed, voltage, terminal length, arc length, etc.
- Method of obtaining a regular weld on straight and circular joints.
- Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
- Characteristics of an ergonomic welding position (review of Competency 3).
- Welding position ensuring stability throughout the process.
- Method of obtaining quality arc strikes.
- Welding methods, e.g. push, pull, travel angle, oscillatory motion of the welding gun, travel speed
- Method of welding at joint restarts.
- Single-bead and multiple-bead welding methods with rutile, basic, metal core and self-shielding electrode wires.
- Welding methods to perform a full penetration pass on a butt joint preparation (rear gouging).
- Welding methods to perform a full penetration pass on a fillet joint preparation (rear gouging).
- Effects of different welding sequences on the distortion of parts and assemblies.
- Importance of welding the entire joint (review of Competency 3).
- Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, etc.
- Measurement of welds using a welding gauge (review of Competency 3).
- Visual detection of the different welding defects.
- Causes of the main welding defects.
- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc.
- Methods of preparing butt and fillet welding samples for a destructive test in accordance with Canadian standards (review of Competency 3).

4. Repair welds and parts.
    - Weld bead defects: crack, undercut, blowout and incomplete fusion.
    - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
    - Methods of repairing welds and broken or worn parts.

5. Finish the job.
    - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 3).
    - Method of cleaning welding set-up components (e.g. gun nozzle, welding gun conduit liner) and the work area.
    - Storage of equipment in the designated places.

Bending and Shaping	Code: 804754

Competency 10 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

Bend and shape metals.

Achievement Context

- Given:
  - oral and written instructions
  - drawings
  - technical documents related to the equipment
  - steel or aluminum plates and structural shapes
- Using:
  - personal and collective protective measures
  - a numerically controlled press brake
  - a plate-bending machine
  - a section-bending machine
  - tools (punches and dies), accessories and equipment

Elements of the Competency	Performance Criteria
1. Prepare to bend and shape metals.	• Accurate verification of the actual dimensions of the plates and structural shapes. • Accurate determination of the length of a part to be bent or shaped. • Appropriate choice and installation of press brake and bending machine tools and accessories. • Precise cutting of parts to be bent and shaped. • Creation of accurate verification templates. • Efficient sequence of operations.
2. Bend metal parts.	• Proper adjustment of numerically controlled press brake settings. • Accurate adjustment of bending angles. • Compliance with required dimensions • Observance of the capacity of the different pieces of equipment.
3. Shape metal parts.	• Precise adjustment of positioning of bending rolls. • Compliance with required dimensions. • Observance of the capacity of the different pieces of equipment.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Thorough verification of the adjustment of the equipment, tools and accessories throughout the job.
- Compliance with oral or written instructions.
- Proper choice and use of materials, tools, accessories and equipment.
- Harmonious and effective communication.

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:

- Hazards associated with bending and shaping, accessories, equipment, etc.
- Data sheets for the different hazardous products used.
- Capacity of bending equipment.
- Bending capacity based on the tools (punches and dies) and material to be bent using a load capacity chart.
- Safe handling of parts (review of Competency 7).
- Identification of zones for moving parts (review of Competency 7).
- Capacity of shaping equipment.
- Method for the adequate use of measuring instruments: tape measure, ruler, square, protractor, micrometer, vernier calliper, thickness gauge.
- Importance of good communication.
- Methods of maintaining healthy communication and using the proper communication channel.

1. Prepare to bend and shape metals.
    - Types of bending punches and dies: capacity and shape of punches and dies.
    - Types of press brakes and their parts (e.g. stationary apron, movable apron).
    - Operation of a three-axis press brake: mechanical part, control panel and safety equipment.
    - Verification and correction of bending angles and positioning of bends.
    - Calculation of the development and positioning of bends using the bend allowance or bend compensation methods, or parameterization software.
    - Bend allowance method of calculation.
    - Bend compensation method of calculation.
    - Method of determining an appropriate bending sequence.
    - Method of avoiding forming marks during bending.
    - Selection of tools with a bending load capacity chart.
    - Installation of press brake tools: punches and dies.
    - Calibration of a press brake, verification of the position of the axes.
    - Marking of bend positions for certain bends.
    - Production of verification pattern.

2. Bend metal parts.

   - Verification of emergency stops and safety devices: laser, light beams.
   - Safe handling of parts to be bent, handling of large parts, movement of part during bending.
   - Proper adjustment of numerically controlled press brake settings.
   - Method of determining the proper position of parts to be bent, position of the part on the die.
   - Method of complying with the established bending sequence.
   - Bending of a part using reference lines on the part.
   - Bending of a part using a stop.
   - Method of verifying the compliance of bent parts: size of the part, position of folds, bending direction, parallel bends.

3. Shape metal parts.

   - Shaping of angle irons, plates, tubes, etc.
   - Methods of shaping to fashion a complete cylinder and a partial cylinder out of plates.
   - Method of pinching a part to be shaped.
   - Adjustment of shaping equipment.
   - Safe handling of parts to be shaped, handling of large parts, movement of part during shaping.
   - Method of verifying the compliance of shaped parts: size of the part, shaping direction and cylindricity.

Welding of Steel and Stainless Steel (GMAW) – Vertical and Overhead Positions	Code:	804765

Competency 11 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Weld steel and stainless steel using the GMAW process in the vertical and overhead positions.

Achievement Context

- When making welds:
  - using the GMAW and GMAW-P processes
  - with and without restarts
- Given:
  - steel and stainless steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - GMAW and GMAW-P welding set-ups
  - a work table
  - tools and equipment
  - shielding gases
  - different types and diameters of electrode wires

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Careful choice of welding set-up. • Careful choice of wire feeder. • Proper preparation of joints to be welded. • Proper installation of electrode wire. • Proper installation of shielding-gas supply system. • Accurate setting of tack-welding parameters.

	• Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
2. Make welds: • full and partial penetration welds on all basic joints on steel. • partial penetration welds on fillet joints on stainless steel.	• Proper adjustment of welding parameters. • Appropriate use of transfer modes in electric arc welding: short circuit, pulse spray. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts and blowouts • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
3. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
4. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with photographs, drawings, etc. • Compliance with welding procedures. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 1 to 10 mm thick.
- Welding of stainless steel, e.g. parts 1 to 4 mm thick.
- Hazards associated with GMAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke) (review of Competency 3).
- Data sheets for the different hazardous products used (review of Competency 3).
- Adjustment of the position of the part or fume and gas exhaust system (review of Competency 3).
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures in vertical and overhead welding against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review of Competency 3).
- Data sheets for the different hazardous products used (review of Competency 3).
- Characteristics of an ergonomic welding position.
- Review of terminology used in the classification of steel: mild, low-alloy, alloy, stainless, etc.
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of Competency 3).
- Characteristics of steel and stainless steel electrode wires: size, classification, etc. (review of Competency 3).
- Characteristics of gases and gas mixes: argon, CO_2, oxygen, etc.
- Expansion and contraction of steel and stainless steel.
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 3).
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 3F, 4F, 3G, 4G, etc.
- Identification of defective couplers or welding cables (review of Competency 3).
- Detection of shielding gas leaks (review of Competency 3).

1. Learn about the job to be done.
    - Zones and different steps in the process (review of Competency 3).
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of manufacturers' recommendations (welding set-up, electrode wires, etc.) (review of Competency 3).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of steel and stainless steel products, e.g. plates, structural shapes (review of Competency 3).
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups.
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing welding set-up components and installation method (review of Competency 3).
    - Criteria for choosing the electrode wire based on the procedure (review of Competency 3).
    - Cleaning of plates (e.g. oxidation, dirt) (review of Competency 3).
    - Preparation of work area.
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
    - Method of tack welding the assembly to reduce distortion.
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting a GMAW welding set-up (review of Competency 3).
    - Types of filler metals used in the industry: brand name and classification according to current Canadian and U.S. standards (e.g. diameter, size).
    - Methods of installing the welding spool, gas cylinder, pressure regulator with flowmeter, welding gun and accessories, etc. (review of Competency 3).
    - Methods of adjusting welding set-up components and parameters.
    - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper fit up of parts.
    - Means of removing a defective weld by CAC and PAC gouging, grinding, etc.
    - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc.

3. Make welds.
    - Characteristics of a quality weld bead: profile, buildup, wetting, etc. (review of Competency 3).
    - Method of adjusting a GMAW welding set-up: wire speed, voltage, terminal length, arc length, etc.
    - Method of adjusting a GMAW-P welding set-up.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
    - Welding position ensuring stability throughout the process.
    - Method of obtaining quality arc strikes.
    - Distinction among the different transfer modes: short circuit, globular and spray (review of Competency 3).
    - Welding methods: position (vertical uphill, vertical downhill), push or pull, travel angle, oscillatory motion of the welding gun, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods.
    - Welding methods to perform a full penetration pass on a butt joint preparation with gap.
    - Welding methods to perform a full penetration pass on a fillet joint preparation.
    - Effects of different welding sequences on the distortion of parts and assemblies (review of Competency 3).
    - Importance of welding the entire length of the joint.
    - Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, etc.
    - Measurement of welds using a welding gauge (review of Competency 3).
    - Visual detection of the different welding defects.
    - Causes of the main welding defects.

- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc. (review of Competency 3).
- Methods of preparing butt and fillet welding samples for a destructive test in accordance with Canadian standards.

4. Repair welds and parts.
   - Weld bead defects: crack, undercut, blowout, incomplete fusion, etc.
   - Review of the methods for removing defective welds by CAC and PAC gouging and grinding (review of competencies 5 and 8).
   - Methods of repairing welds and broken or worn parts.
   - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
   - Type of support for maintaining the weld puddle during the repair.

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 3).
   - Method of cleaning welding set-up components (e.g. gun nozzle, welding gun conduit liner) and the work area (review of Competency 3).
   - Storage of equipment in the designated places (review of Competency 3).

Drilling, Punching and Bolting	Code: 804772

Competency 12 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

Drill, punch and bolt metals.

Achievement Context

- Given:
  - irregular steel and aluminum plates, structural shapes and cylindrical parts of different thicknesses
  - oral and written instructions
  - drawings and sketches
  - existing threads in a hole, a screw or a rod
  - screws, nuts, etc., to be reproduced or ordered
- Using:
  - personal and collective protective measures
  - the necessary tools and equipment
  - various tables, etc.

Elements of the Competency	Performance Criteria
1. Mark the position of the holes to be drilled or punched in a part.	• Careful choice of marking and measuring instruments. • Accurate and precise measurements. • Accurate marking of the position of the holes to be drilled or punched. • Accurate verification of marking and correction as needed.
2. Drill parts.	• Correct determination of sequence of operations. • Careful choice of drill based on the type of material, its thickness and the position of the hole. • Appropriate choice of drill bit. • Proper choice of rotation speed. • Proper positioning of parts to be drilled. • Proper deburring of holes.

3. Punch holes in parts.	• Careful choice of equipment based on the type of metal and its thickness. • Appropriate choice of punch and die. • Proper installation of punch and die. • Proper positioning of parts to be punched. • Proper deburring of holes.
4. Manually tap parts.	• Proper measurement of thread in a hole or on a rod, if applicable. • Accurate choice of tap or die based on the type of thread to be cut. • Proper manual tapping. • Precise alignment of tapping. • Quality of threads.
5. Bolt parts.	• Accurate selection of bolts based on the thread. • Accurate selection of tool based on the type of bolting required. • Use of appropriate torque.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Appropriate use of cooling fluid. • Solid fastening of parts. • Compliance with tolerances. • Observance of the capacity of the equipment and tools. • Harmonious and effective communication. • Thorough cleaning and proper storage of equipment 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:

- Hazards associated with drilling, punching and bolting, accessories, equipment, etc.
- Data sheets for the different hazardous products used.
- Determination of a safe work area.
- Sequence of operations and importance of compliance with checkpoints.
- Identification of metals to be drilled or punched.
- Distinction among the different activities related to drilling and punching: drilling, punching, reaming, bevelling, counterboring, spotfacing, countersinking, etc.
- Rotation speed when drilling, bevelling, counterboring and spotfacing.
- Types of threads: imperial and metric systems, pipe threads, etc.
- Types of mechanical screws and bolts: classification, torque.

- Measurement of threads: diameter, pitch, type of thread.
- Standard thread chart: selection of type of thread, diameter, pitch, etc.
- Importance of good communication.
- Methods of maintaining healthy communication and using the proper communication channel.

1. Mark the position of the holes to be drilled or punched in a part.
   - Marking tools: chalk, scriber, centre punch, bluing (review of Competency 5).
   - Measuring tools: tape measure, ruler, checking template, vernier and micrometer (review of Competency 5).
   - Creation of a marking pattern.

2. Drill parts.
   - Distinction among the different types of rotary drills: hand drill, magnetic drill, drill press, etc.
   - Characteristics and capacity of hand drills: power, maximum drilling diameter.
   - Characteristics and capacity of drill presses: power, maximum drilling diameter.
   - Distinction among the different methods of installing drill bits.
   - Distinction among the different types of chucks.
   - Method of sharpening drill bits: grinding angle, grinding gauge, type of grinding wheel used.
   - Advantages and disadvantages of drilling with a drill bit or punch-die.
   - Use of table of recommended rotation speeds.
   - Method of adjusting drilling speed.
   - Quality of drilling and grinding of drill bit.
   - Characteristics of the different types of drill bits and hole saws.
   - Importance of removing the metal filings on an ongoing basis.
   - Method of using a grinder and deburring tool (review of Competency 5).
   - Method of using a countersink cutter.

3. Punch holes in parts.
   - Characteristics and capacity of punches.
   - Types of punches and dies: round, oblong, square, etc.
   - Clearance between the punch and die.
   - Maximum capacity of a punch.
   - Use of the table needed to determine the clearance between the punches and dies.
   - Installation of punch and die.
   - Positioning guide for punching.
   - Use of punching force (tonnage) table.
   - Impact of punch and die wear on the quality of the hole.

4. Manually tap parts.
   - Method of using taps, dies, tap wrenches, thread chasers.
   - Method of performing manual tapping using a tapping head.
   - Distinction among the different tapping lubricants and their use.

5. Bolt parts.
   - Method of using tightening tools: screwdriver, wrench, ratchet, etc.
   - Manual and mechanical tightening tools.
   - Characteristics of torque (inch-pound, foot-pound, newton-metre).
   - Characteristics and adjustment of a torque wrench.
   - Determination of tightening sequence based on the number of bolts and their pattern.

Simple Assemblies	Code: 804785

Competency 13 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Create simple assemblies.

Achievement Context

- Given:
  - steel plates and structural shapes and assemblies to be repaired or modified
  - oral or written instructions
  - simple assembly drawings
  - simple procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - prepared parts
  - an assembly table
  - simple jigs, if applicable
  - tools
  - a GMAW or FCAW welding set-up
  - digital tools

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Accurate interpretation of: – oral and written instructions – drawings – procedures – manufacturers' recommendations(e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Determination of an efficient procedure, if applicable. • Proper determination of parts to be assembled, if applicable. • Careful choices for making a jig. • Proper creation of a jig, if applicable. • Accurate measurement of parts to be assembled. • Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified.

Simple Assemblies	Code: 804785
3. Position and tack weld the parts.	• Proper positioning of jig, if applicable. • Precise positioning of each part. • Proper squaring of parts. • Appropriate orientation of parts. • Assembly method minimizing the risk of distortion during welding. • Appropriate tack welding of assembly.
4. Check the quality of the assemblies and make the necessary corrective measures.	• Thorough inspection of assemblies. • Detection of any abnormalities. • Determination of the appropriate corrective measures for identified defects. • Accurate determination of the part or parts to be moved, repaired or replaced. • Careful choice of method for removing one or more parts of the assembly. • Careful removal of the part or parts, if applicable. • Proper relocation, repair or replacement of parts.
5. Weld the assemblies.	• Precise assembly and adjustment of welding set-up. • Compliance with welding procedure. • Effective control of distortion. • Precise positioning of welds. • Thorough identification and correction of defects as they arise.
6. Repair or modify the assemblies.	• Observance of procedure. • Appropriate assembly of repaired components. • Appropriate finishing of repair.
7. Finish the job.	• Proper choice and use of finishing tools. • Careful finishing of assemblies. • Absence of damage to the parts. • Detection of any abnormalities. • Proper cleaning and storage of equipment and tools, and proper cleaning of the work area. • Recording of relevant information on the work order.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Appropriate handling and lifting of parts and assemblies.
- Compliance with tolerances indicated in the drawings.
- Compliance with oral or written instructions.
- Accurate interpretation of drawings and procedures.
- Compliance with manufacturers' recommendations.
- Harmonious and effective communication.

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:

- Hazards associated with assembly work, accessories, equipment, etc. (e.g. band saw, shear, press brake) (review of competencies 5, 8, 10 and 12).
- Data sheets for the different hazardous products used.
- Importance of a clean work area.
- Tools authorized for the job.
- Precautions to take to avoid damaging parts and assemblies when working.
- Common damage: distortion, sagging of tack welds or weld beads, spatter, etc.
- Methods of checking the compliance of the assembly with shape, positioning and geometric tolerances: ruler or tape measure for positioning, square for squareness, straightedge for alignment, etc.
- Importance of communication during production.
- Consequences of poor or no communication.
- Strategies for finding information in paper and digital documents.

1. Learn about the job to be done.
   - Choice of drawings: title; project, contract and version numbers, etc.
   - Contents of work order: order number, project number, project manager, etc.
   - Material list: shape, dimensions, quantity, materials, etc.
   - Assembly procedure: assembly and subassembly, use of a jig, free assembly.
   - Distinction between isometric and orthographic projections (review of Competency 6).
   - Distinction among the different views in a drawing: front, side, top, etc. (review of Competency 6).
   - Distinction among drawings based on the views they represent (review of Competency 6).
   - Verification of instructions in the drawing: general, local and special notes (review of Competency 6).
   - Interpretation of welding procedure: procedure number, process to use, etc.
   - Strategies for finding information in paper and digital documents.
   - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Characteristics of simple assemblies, for example:
        - few different parts
        - parts 3 mm thick or thicker
        - 90-degree assembly angle
        - broad tolerances of up to 3 mm for some parts of the assembly
        - use of the following measuring instruments: tape measure, ruler, square
        - use of a jig or a simple assembly guide
    - Determination of the section of the assembly to be repaired or modified, if applicable.
    - Characteristics of a safe work area: sufficient space to do the job, installation of screens if applicable, etc.
    - Criteria determining whether or not a jig should be made.
    - Preparation of work surface: assembly table, jig.
    - Production of a cutting list: number of parts to be cut, materials, quantity, equipment needed, specific details (e.g. straight or angular cuts).
    - Distinction among the different measuring instruments required: tape measure, square, vernier calliper, ruler, etc. (review of Competency 5).
    - Criteria for choosing measuring instruments based on the required precision, the dimensions to be measured and the type of measurement (e.g. angle, squareness, parallelism, flatness).
    - Specific characteristics of assembly tools: vises, self-locking pliers, clamps, pipe clamps, hammers, jigs, etc.
    - Method of making reference marks on the parts to be assembled.
    - Identification of parts using markers, punches, etc.
    - Choice of method for removing a section of the assembly: chisel, grinding wheel, OFC, PAC, etc.
    - Methods of preparing and cleaning parts to be assembled and assemblies to be repaired or modified: cleaners, sanding, brushing, etc.
    - Common non-conformities of prepared parts: wrong dimensions, incorrect positioning, inappropriate machining, poor preparation, etc.
    - Verification of dimensional, positioning and geometric tolerances.
    - Method of using verification tools: tape measure, ruler, square, vernier calliper, go/no go gauge.
    - Arrangement of parts.

3. Position and tack weld the parts.
    - Choice of assembly method based on the preparation of the parts.
    - Method of using assembly tools: assembly table, self-locking pliers, clamps, vises, hammers, hinge handles, jigs.
    - Marking tools: chalk, scriber, marking gauge, ruler, compass, beam compass (review of Competency 5).
    - Methods of marking to position parts: parallel lines, perpendicular lines, oblique lines, circular lines, pattern, etc.
    - Tack-welding method: determination of best place to tack weld, the size of the tack welds and the ideal number of tack welds.
    - Control of distortion using tools to hold parts in place.
    - Control of distortion due to the positioning of parts in opposite tilt directions.
    - Assembly of 90-degree angle iron, 90-degree return bend, 90-degree HSS.
    - Methods of positioning parts based on distance, squareness, alignment or orientation.

4. Check the quality of the assemblies and make the necessary corrective measures.
    - Method of verifying distances using a straightedge.
    - Methods of verifying squareness using a combination square, carpenter's square, precision square, level, etc.
    - Method of verifying flatness and parallelism using a tape measure and straightedge, a tape measure and square, etc.
    - Method of verifying positioning using a go/no go gauge.
    - Verification of the flatness of a work surface.
    - Choice of method for removing a part from an assembly based on the accessibility of the tack weld, the position and rigidity of the part and the amount of weld to be removed.
    - Choice of method for removing a part from an assembly: chisel, grinder or thermal cutting process.
    - Method of gouging and cutting a tack weld in an assembly (review of competencies 5 and 8).
    - Method of cleaning a repaired part.

5. Weld the assemblies.
    - Determination of welding sequence for plates and structural shapes based on the type of assembly and the required dimensions and depths of the weld beads.
    - Welding method based on the welding procedure, the accessibility of the joint to be welded and the ability to control distortion of the assembly.
    - Determination of welds to be made first in anticipation of limited access, in order to reduce distortion, etc.
    - Weld bead defects related to their dimensions, regularity, fusion to the part, profile, presence of undercuts or blowouts or, if applicable, slag inclusion.
    - Method of gouging and cutting a weld in an assembly: determination of path of cutting stream to avoid damaging the assembly or causing injury, use of a method to avoid contact between the carbon electrode and the assembly, use of additional protective equipment (review of Competency 8).
    - Method of cleaning a repaired part.

6. Repair or modify the assemblies.
    - Method of removing a section of the assembly: chisel, grinding wheel, OFC, PAC, etc.
    - Method of straightening an assembly or section of an assembly: cold forging, hot forging.
    - Adjustment and assembly of repaired components.
    - Finishing of a repaired assembly: choice of finishing grain (grinding or sanding) to obtain a uniform surface.

7. Finish the job.
    - Choice and use of finishing tools: grinding wheel on a portable grinder, sandpaper on a portable grinder, etc. (review of Competency 5).
    - Methods of reducing the number of marks and scratches on a welded assembly.
    - Tools for cleaning assemblies: chipping hammer, metal brush, scraper, chisel, file, grinder, sander, etc.
    - Removal of spatter on the surface of the assembly, the jig and the tools used.
    - Removal of tack welds used to hold the parts temporarily in place on the surface and on the jig.
    - Recording of information on the order form for production monitoring: steps completed, by whom, when, etc.

Welding of Steel and Stainless Steel (SMAW) – Flat and Horizontal Positions	Code:	804795

Competency 14 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Weld steel and stainless steel using the SMAW process in the flat and horizontal positions.

Achievement Context

- Making welds with and without restarts.
- Given:
  - steel and stainless steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - a SMAW welding set-up
  - a work table
  - tools and equipment
  - different types and diameters of coated electrodes

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – the repair to be done – manufacturers' recommendations (e.g. for the welding set-up, coated electrodes)
2. Prepare the work.	• Careful choice and proper installation of SMAW welding set-up components. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.

3. Make welds: • full and partial penetration welds on all basic joints on steel. • partial penetration welds on fillet joints on stainless steel.	• Proper adjustment of welding parameters. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts or blowouts – slag inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with welding procedures. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Appropriate use of weld gauge. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 3 to 10 mm thick.
- Welding of stainless steel, e.g. parts 3 to 6 mm thick.
- Hazards associated with SMAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system.

- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Data sheets for the different hazardous products used.
- Characteristics of an ergonomic welding position.
- Terminology used in the classification of steel: mild, low-alloy, alloy, stainless, etc. (review of Competency 3).
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of Competency 3).
- Characteristics of steel- and stainless steel-coated electrodes: size, classification, etc.
- Method of storing the different types of coated electrodes.
- Expansion and contraction of steel and other metals (review of Competency 3).
- Operation of a SMAW welding set-up.
- Specific characteristics of SMAW welding set-ups depending on the manufacturer.
- Basic principles of an electrical circuit in a SMAW welding set-up: current flow, direct current, alternating current, electrical resistance, inductance, etc.
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 1F, 2F, 1G, 2G, etc. (review of Competency 3).
- Identification of defective couplers or welding cables.

1. Learn about the job to be done.
    - Zones and different steps in the process.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, coated electrodes).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of steel and stainless steel products, e.g. plates, structural shapes (review of Competency 3).
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups.
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing a SMAW welding set-up.
    - Criteria for choosing components of a constant-current welding set-up and installation method.
    - Characteristics of coated electrodes: types of flux, welding parameters.
    - Criteria for choosing the appropriate coated electrode.
    - Cleaning of plates and welds to be repaired (e.g. oxidation, dirt) (review of Competency 3).
    - Preparation of work area.
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
    - Role of tack welding in reducing distortion.
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting a SMAW welding set-up: power, arc time factor, etc.

- Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size).
- Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper fit up of parts.
- Methods of removing defective welds by CAC and PAC gouging, grinding, etc. (review of competencies 5 and 8).
- Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc.

3. Make welds.

- Characteristics of a quality weld bead: profile, buildup, wetting, etc.
- Method of adjusting a SMAW welding set-up: hot start, adjustment of voltage current slope, remote control.
- Method of obtaining a regular weld on straight and circular joints.
- Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
- Welding position ensuring stability throughout the process.
- Method of obtaining quality arc strikes.
- Welding methods, e.g. travel angle, oscillatory motion of the coated electrode, arc length, travel speed.
- Method of welding at joint restarts.
- Single-bead and multiple-bead welding methods with cellulose-coated, basic-coated and rutile-coated electrodes.
- Welding methods to perform a full penetration pass on a butt joint preparation with gap.
- Welding methods to perform a full penetration pass on a fillet joint preparation.
- Effects of different welding sequences on the distortion of parts and assemblies.
- Importance of welding the entire joint (review of Competency 3).
- Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, slag inclusion, etc.
- Measurement of welds using a welding gauge (review of Competency 3).
- Visual detection of the different welding defects.
- Causes of the main welding defects.
- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Methods of preparing butt and fillet welding samples for a destructive test in accordance with Canadian standards (review of Competency 3).
- Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc. (review of Competency 3).

4. Repair welds and parts.

- Weld bead defects: crack, undercut, blowout, incomplete fusion, etc.
- Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
- Methods of repairing welds and broken or worn parts (review of Competency 9).
- Type of support for maintaining the weld puddle during the repair (review of Competency 9).

5. Finish the job.

- Shutdown of welding set-up and other equipment, disconnection of power source, etc.
- Method of cleaning welding set-up components and the work area.
- Storage of equipment in the designated places.

Complex Assembly Drawings	Code: 804807

Competency 15 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Interpret complex assembly drawings.

Achievement Context

- Given:
  - oral or written instructions
  - complex assembly drawings in isometric or orthographic (American and European) projection:
    - equipment and machine drawings
    - shop drawings of steel structures
  - manufacturer's recommendations
- Using:
  - personal and collective protective measures
  - digital tools
  - catalogues of metal product manufacturers

Elements of the Competency	Performance Criteria
1. Interpret the projections and views used in a complex assembly drawing.	• Accurate determination of the type of projection used. • Correct interpretation of the different types of lines. • Proper distinction among the different views used. • Accurate association of data between the different views represented. • Accurate interpretation of the specific characteristics of shop drawings of structures.
2. Interpret the dimensions and notes used in a complex assembly drawing.	• Accurate interpretation of: – shape and position values – dimensional tolerances – general and local notes – material list – specific characteristics of shop drawings of structures
3. Interpret the geometric tolerance symbols used in a complex assembly drawing.	• Accurate interpretation of shape tolerances. • Accurate interpretation of orientation tolerances. • Accurate interpretation of positioning tolerances.

4. Interpret the welding symbols used in a complex assembly drawing.	• Accurate interpretation of welding symbols for a U-groove preparation, a J-groove preparation and a preparation with spacing jig. • Accurate interpretation of symbols for a welding procedure in several steps. • Accurate interpretation of weld pitch and length.
5. Produce a list for the preparation of parts based on a complex assembly drawing.	• Location of all elements in a complex assembly drawing. • Production of a complete preparation list taking into account the equipment to be used. • Optimal planning of cuts to conserve materials.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Accurate conversion of units of measurement. • Thorough verification of the accuracy of the data.

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:

- Types of steel structure drawings: architectural plan, engineering drawing, installation sketch, anchoring plan, shop drawing.
- Units of measurement used in technical drawings, and conversion of units from the international to the imperial system and vice versa (review of Competency 4).
- Arrangement of information in a shop drawing: frame, title block, identification, bill of material.
- Strategies for finding information in paper and digital documents.
- Basic functions needed to view digital technical drawings.

1. Interpret the projections and views used in a complex assembly drawing.
   - Choice of an assembly drawing: project name or number, version, drawings referring to the assembly, etc.
   - Choice of shop drawing of a structure: project name or number, version, quantity, points of the compass, etc.
   - Determination of the views used in complex assembly drawings: complete drawing with detail drawings, sectional views with sectional drawings, partial views, etc.
   - Association of information in an assembly drawing with the information in the detail drawings: association of the different views (in orthographic and isometric projection), positioning measurements, orientation measurements, tolerances associated with each part.
   - Material list for an assembly drawing: identification of parts, types of materials, shapes, dimensions, quantities (review of Competency 6).

- Location of the position of the different parts to be assembled: positioning and orientation of parts.
- Specific views in a shop drawing of a structure: base plate view.
- Conventions used in shop drawings of structures: lines, partial views, dimensioning lines, holes, primary parts, secondary parts, notches, measuring lines, fasteners, annotations, etc.

2. Interpret the dimensions and notes used in a complex assembly drawing.
   - Information in an assembly drawing: general and local notes, number of assemblies to be produced, cutting, drilling and punching methods, etc.
   - Location of dimensions on the different views of an assembly drawing made up of several pages: finding a dimension in a detail drawing based on the assembly drawing.
   - Position of the measuring line or origin and the related dimensions.
   - Interpretation of dimension tolerances: unidirectional, bidirectional, combined, etc.
   - Identification of the different parts of a metal frame: column, beam, sill, tie, brace, truss, joist, lintel, etc.
   - Position of standardized holes in structural shapes.
   - Bill of material for a shop drawing of a structure: brand, quantity, description, weight, dimensions.
   - Association of tolerances with the appropriate manufacturing processes: oxy-fuel cutting, plasma arc cutting, shearing, etc. (review of competencies 5 and 8).

3. Interpret the geometric tolerance symbols used in a complex assembly drawing.
   - Shape tolerance symbols: flatness, cylindricity, line shape.
   - Orientation tolerance symbols: parallelism, squareness, slope, line orientation.
   - Positioning tolerance symbols: location, concentricity, coaxiality, symmetry, line position.
   - Measuring instruments used to verify compliance with tolerances: tape measure, square, ruler, protractor, etc.

4. Interpret the welding symbols used in a complex assembly drawing.
   - Interpretation of welding procedures: welding process, filler metals, shielding gases, welding parameters, etc. (review of competencies 3 and 9).
   - Method of preparing welding joints: double-bevel groove, double-fillet welds, J-groove, U-groove.
   - Advantages and disadvantages of preparing complex weld joints: preparation method, welding time.
   - Multiple datum lines: steps in the procedure.
   - Symbols determining the length and pitch of a weld: intermittent weld, staggered weld, starting point, centre-to-centre distance, symmetrical distribution of welds.
   - Distinction between American and European symbols: datum line, effective throat thickness, etc.

5. Produce a list for the preparation of parts based on a complex assembly drawing.
   - Recording of all the elements of an assembly drawing: part numbers, quantity, types of materials, shapes, dimensions, etc.
   - Production of a preparation list for the different equipment: shear, band saw, abrasive saw, drill, punch, etc.
   - Choice of preparation equipment based on capacities and tolerances.
   - Planning of cuts to conserve materials.

Structural Assemblies	Code: 804817

Competency 16 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

Create structural assemblies.

Achievement Context

- Given:
  - steel plates and structural shapes and assemblies to be repaired or modified
  - oral or written instructions
  - shop drawings for manufacturing structures
  - procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an assembly table
  - jigs, if applicable
  - tools
  - digital tools
  - a GMAW, FCAW or SMAW welding set-up

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Accurate interpretation of: – oral and written instructions – shop drawings for manufacturing structures – procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Careful choice of whether or not to make a jig. • Proper creation of a jig, if applicable. • Proper determination of parts to be assembled, if applicable. • Accurate measurement of parts to be assembled. • Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified.

3. Position and tack weld the parts.	• Proper positioning of jig, if applicable. • Precise positioning of each part. • Proper squaring of parts. • Appropriate orientation of parts. • Assembly method minimizing the risk of distortion during welding. • Appropriate tack welding of assemblies.
4. Check the quality of the assemblies and make the necessary corrective measures.	• Thorough inspection of assemblies. • Detection of any abnormalities. • Determination of the appropriate corrective measures for identified defects. • Accurate determination of the part or parts to be moved, repaired or replaced. • Careful choice of method for removing one or more parts of an assembly. • Careful removal of the part or parts, if applicable. • Proper relocation, repair or replacement of parts.
5. Weld the assemblies.	• Precise assembly and adjustment of welding set-up. • Compliance with welding procedure. • Effective control of distortion. • Precise positioning of welds. • Thorough identification and correction of defects as they arise.
6. Repair or modify the assemblies.	• Observance of procedure. • Effective removal of parts or components, if applicable. • Appropriate assembly of repaired components. • Appropriate finishing of repair.
7. Finish the job.	• Proper choice and use of finishing tools. • Careful finishing of assemblies. • Absence of damage to the parts. • Detection of any abnormalities. • Proper cleaning and storage of equipment and tools, and proper cleaning of the work area. • Recording of relevant information on the work order.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Appropriate handling and lifting of parts and assemblies.
- Compliance with tolerances indicated in the drawings.
- Compliance with oral or written instructions.
- Accurate interpretation of drawings and procedures.
- Compliance with manufacturers' recommendations.
- Harmonious and effective communication.

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:

- Hazards associated with assembly work, accessories, equipment, etc. (e.g. band saw, shear, press brake) (review of competencies 5, 8, 10 and 12).
- Data sheets for the different hazardous products used.
- Importance of a clean work area.
- Tools authorized for the job.
- Precautions to take to avoid damaging parts and assemblies when working.
- Common damage: distortion, sagging of weld bead, spatter, etc.
- Methods of checking the compliance of the assembly with shape, positioning and geometric tolerances: ruler or tape measure for positioning, square for squareness, straightedge for alignment, etc.
- Importance of communication during production.
- Consequences of poor or no communication.

1. Learn about the job to be done.
    - Choice of drawings: title; project, contract and version numbers, etc.
    - Contents of work order: order number, project number, project manager, etc.
    - Types of parts to be assembled: beams, columns, related parts, etc.
    - Material list for the assembly of steel structures: shapes, dimensions, quantities, materials.
    - Recognition of the specific symbols in structural drawings related to the preparation and assembly of parts.
    - Assembly procedure: assembly and subassembly, use of a jig, free assembly.
    - Distinction between isometric and orthographic projections.
    - Distinction among the different views in a drawing: front, side, top, etc.
    - Interpretation of the different symbols specific to steel structure drawings.
    - Distinction among drawings based on the views they represent.
    - Verification of instructions in the drawing: general, local and special notes.
    - Interpretation of welding procedure: procedure number, process to use, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
   - Characteristics of structural assemblies, for example:
     - different parts
     - parts 3 mm thick or thicker
     - range of assembly levels
     - average tolerances of up to 2 mm for some parts of the assemblies
     - use of the following measuring instruments: tape measure, ruler, square
     - use of a jig or simple assembly guide
   - Characteristics of a safe work area: sufficient space to do the job, installation of screens if applicable, etc.
   - Criteria determining whether or not a jig should be made.
   - Preparation of work surface: assembly table, jig.
   - Determination of the section of the assembly to be repaired or modified, if applicable.
   - Production of a cutting list: number of parts to be cut, materials, quantity, equipment needed, specific details (e.g. straight or angular cuts).
   - Distinction among the different measuring instruments required: tape measure, square, vernier calliper, ruler, etc.
   - Criteria for choosing measuring instruments based on the required precision, the dimensions to be measured and the type of measurement (e.g. angle, squareness, parallelism, flatness) (review of Competency 5).
   - Specific characteristics of assembly tools: vises, self-locking pliers, clamps, pipe clamps, hammers, jigs, etc. (review of Competency 13).
   - Method of marking parts to be prepared and assembled (review of Competency 13).
   - Identification of parts using markers, punches, etc. (review of Competency 13).
   - Methods of preparing and cleaning parts to be assembled or sections to be repaired or modified: cleaners, sanding, brushing, etc.
   - Common non-conformities of prepared parts: wrong dimensions, incorrect positioning, inappropriate machining, poor preparation, etc. (review of Competency 13).
   - Verification of dimensional, positioning and geometric tolerances (review of Competency 13).
   - Method of using verification tools: tape measure, ruler, square, vernier calliper, go/no go gauge (review of Competency 13).
   - Arrangement of parts.

3. Position and tack weld the parts.
   - Choice of assembly method based on the preparation of the parts (review of Competency 13).
   - Method of using assembly tools: assembly table and support, self-locking pliers, clamps, vises, hammers, hinge handles, jigs (review of Competency 13).
   - Marking tools: chalk, scriber, marking gauge, ruler, compass, beam compass.
   - Methods of marking to position parallel or perpendicular parts: parallel lines, perpendicular lines, oblique lines, circular lines, pattern, etc. (review of Competency 13).
   - Methods of positioning parts at angles other than 90 degrees: using a protractor, pattern, etc.
   - Tack-welding method: determination of best place to tack weld, the size of the tack welds and the ideal number of tack welds.
   - Control of distortion using tools to hold parts in place (review of Competency 13).
   - Control of distortion due to the positioning of parts in opposite tilt directions (review of Competency 13).
   - Assembly of plates and structural shapes.
   - Methods of positioning parts based on distance, squareness, alignment or orientation.

4. Check the quality of the assemblies and make the necessary corrective measures.
   - Method of verifying distances using a straightedge (review of Competency 13).
   - Methods of verifying squareness using a combination square, carpenter's square, precision square, level, etc. (review of Competency 13).
   - Method of verifying parallelism using a tape measure and straightedge, a tape measure and square, etc. (review of Competency 13).
   - Choice of method for removing a part from an assembly based on the accessibility of the tack weld, the position and rigidity of the part and the amount of weld to be removed (review of Competency 13).
   - Choice of method for removing a part from an assembly: chisel, grinder or thermal cutting process (review of Competency 13).
   - Method of gouging and cutting a tack weld in a steel structural assembly (review of Competency 13).
   - Method of cleaning a repaired part (review of Competency 13).

5. Weld the assemblies.
   - Determination of welding sequence for parts based on the type of assembly and the required dimensions and depths of the weld beads (review of Competency 13).
   - Welding method based on the welding procedure, the accessibility of the joint to be welded and the ability to control distortion of the assembly (review of Competency 13).
   - Determination of welds to be made first in anticipation of limited access, in order to reduce distortion, etc. (review of Competency 13).
   - Weld bead defects related to their dimensions, regularity, fusion to the part, profile, presence of undercuts or blowouts or, if applicable, slag inclusion (review of Competency 13).
   - Method of gouging and cutting a weld in an assembly: determination of path of cutting stream to avoid damaging the assembly or causing injury, use of a method to avoid contact between the carbon electrode and the assembly, use of additional protective equipment (review of competencies 5 and 8).
   - Method of cleaning a repaired part.

6. Repair or modify the assemblies.
   - Choice of method of removing a section of the assembly: chisel, grinding wheel, OFC, PAC, etc.
   - Choice of method for straightening an assembly or section of an assembly: cold forging, hot forging.
   - Method of adjusting and assembling repaired components.
   - Method of finishing a repaired assembly: choice of finishing grain (grinding or sanding) to obtain a uniform surface.

7. Finish the job.
   - Choice and use of finishing tools: grinding wheel on a portable grinder, sandpaper on a portable grinder, etc. (review of Competency 5)
   - Methods of reducing the number of marks and scratches on a welded assembly (review of Competency 13).
   - Tools for cleaning assemblies: chipping hammer, metal brush, scraper, chisel, file, grinder, sander, etc. (review of Competency 13)
   - Removal of spatter on the surface of the assembly, the jig and the tools used
   - Removal of tack welds used to hold the parts temporarily in place on the surface and on the jig (review of Competency 13).
   - Recording of information on the order form for production monitoring: steps completed, by whom, when, etc. (review of Competency 13)

Welding and Cutting Procedures	Code: 804822

Competency 17 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

Establish welding and cutting procedures.

Achievement Context

- Given ferrous or non-ferrous metal parts to be assembled, repaired or modified
- Using:
  - personal and collective protective measures
  - metal classification tables
  - filler metal selection charts
  - preheating temperature charts
  - a GMAW, FCAW or SMAW welding set-up
  - an OFC, PAC or CAC cutting set-up
  - user manuals for the welding and cutting set-ups

Elements of the Competency	Performance Criteria
1. Prepare the work.	• Accurate identification of the metal to be welded or cut. • Consideration of prior heat treatments, if applicable. • Proper determination of the weldability of the metal. • Accurate determination of the preparation needed for the weld or cut. • Proper determination of a welding or cutting sequence to minimize distortion. • Proper determination of heat treatments required.
2. Choose the welding and cutting processes and equipment.	• Consideration of: – alloy and welding or cutting position – equipment available and its capacity – available current – place (e.g. worksite, shop) where the job will be done • Careful choice of procedure, set-up and components.

3. Choose the welding and cutting consumables.	• Consideration of: – alloy and welding or cutting position – desired properties – desired welding or cutting speed – ease of performing the task – place (e.g. worksite, shop) where the job will be done • Careful choice of filler metals and shielding and cutting gases.
4. Establish the welding and cutting parameters.	• Appropriate initial parameters. • Thorough testing of initial parameters. • Accurate adjustment of parameters on an ongoing basis. • Accurate determination of final parameters.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Appropriate choice and use of measuring instruments, tools and equipment. • Recording of relevant information at each step.

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:

- Welding technique for repairing and welding poorly adjusted joints.
- Determination of a safe work area (review of Competency 3).
- Additional protection against the heat generated by preheating.
- Usefulness of recording relevant information concerning preparation tasks, the choice of consumables, the choice of process and equipment and the final parameters determined.
- Recording of steps, operations, processes and consumables, heat treatment, sequence of operations, alloys and filler metal, etc.
- Recording of parameters, welding or cutting position, gas flow or pressure, the current used, the position of the torch and travel speed, etc.

1. Prepare the work.
   - Identification of metals based on their standardized classification, for example, CSA Group, American Iron and Steel Institute (AISI), American Society of Mechanical Engineers (ASME), etc. (review of competencies 3, 9 and 14).
   - Identification of metals based on their properties: colour, mass, sparks, magnetism, density, chemical reactions, types of fractures, etc.

- Carbon equivalent content of different types of steel.
- Weldability of ferrous metals: steel and cast iron.
- Weldability of non-ferrous metals: aluminum, magnesium, nickel, and copper and its alloys.
- Causes of hot cracking and cold cracking.
- Effect of hydrogen on the weld: hydrogen diffusion in steel.
- Heat affected zone (HAZ) in the different welding processes.
- Modification of the structure of metals by heat.
- Linear energy induced by cutting and welding.
- Mechanical properties of metals: hardness, malleability, tensile strength, yield strength, wear resistance, shock resistance, corrosion resistance.
- Method of verifying the hardness of metals using a file or hardness tester (Rockwell or Brinell).
- Effect of the type of bevel and its angle (e.g. V, U) on the distortion of the parts to be welded.
- Welding contamination: surface oxidation, paint, oil, water, galvanization, etc.
- Profile of weld bead according to the preparation and bevel in the different welding processes.
- Characteristics of the different heat treatments: hardening, tempering, stress relief annealing and full annealing.
- Internal stress due to welding and cutting operations.
- Methods used to verify the preheating temperature: crayon, gun, etc.
- Method of preheating or post-heating.
- Preheating to increase weldability and reduce distortion: temperatures for preheating, between passes and post-heating.
- Cleaning methods: metal brush, grinder, degreaser, etc.

2. Choose the welding and cutting processes and equipment.
    - Advantages and disadvantages of the GMAW, GMAW-P, FCAW and SMAW welding processes, penetration depth, dilution of weld bead, spatter, deposit rate, etc.
    - Advantages and disadvantages of the OFC, PAC and CAC cutting processes in terms of ease of use, cutting stream, quality and speed of cuts, etc. (review of Competency 8).
    - Capacity of cutting and welding equipment in terms of arc time factor, maximum intensity of current and voltage, and the work area the processes can cover.
    - Capacity of welding and cutting accessories: capacity of the welding nozzle based on intensity of current and the type of gas used, capacity of welding cable based on the length of the cables, capacity of the welding torch and water-cooled accessories, etc.

3. Choose the welding and cutting consumables.
    - Characteristics of filler metals: type of alloy and format, basic composition, welding position, effect on the profile of weld bead, effect on penetration, etc.
    - Classification of filler metals for the GMAW, FCAW and SMAW processes based on the usual standards and for the main metals used in welding.
    - Choice of filler metals for the desired properties: mechanical strength, hardness, corrosion resistance, appearance, etc.
    - Choice of filler metals for the welding speed: effect of the diameter and type of electrode on the welding speed.
    - Characteristics of inert or non-inert welding gases or gas mixes.
    - Filler metal and shielding gas selection charts.
    - Choice of cutting gas based on the desired properties: clean cuts, prevention of distortion and cracks, etc.
    - Choice of cutting gas based on speed and ease of performing the task, arc strike speed, travel speed, post-cutting cleaning time, etc.

- Effect of thermal cutting on carbon, alloy and stainless steel, aluminum, etc.
- Characteristics of cutting gases (oxidizing gases and fuels): calorific value, flame temperature, etc.

4. Establish the welding and cutting parameters.
   - Review of the different welding parameters by welding process, filler metal and welding position: voltage, current, wire speed, wire diameter, terminal length and arc length (review of competencies 3, 9 and 14).
   - Effects of the parameters on the bead profile, penetration and quality of the weld: intensity of current, voltage, electrode angle, travel speed, terminal length, etc.
   - Welding parameters that provide a satisfactory bead profile, sufficient penetration and sound weld, and minimize distortion (review of competencies 3, 9 and 14).
   - Welding method to minimize distortion: back-step welding, etc. (review of competencies 3, 9 and 14)
   - Adjustment of the different welding parameters without using measuring instruments such as a voltmeter, ammeter, electrode wire-feed speed indicator (review of competencies 3, 9 and 14).
   - Method of performing a satisfactory welding test: use of parts of the same size, made of the same material and with the same preparation method, etc.
   - Electric arc: arc blow created by a magnetic field (review of competencies 3, 9 and 14).
   - Verification of the weld's dimensions, the profile of the weld bead and the penetration (review of competencies 3, 9 and 14).

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc.
   - Method of cleaning the welding set-up components (e.g. nozzle, collar, gas diffuser) and the work area.
   - Storage of equipment in the designated places.

Welding of Steel (FCAW) – Vertical and Overhead Positions	Code: 804833

Competency 18 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

Weld steel using the FCAW process in the vertical and overhead positions.

Achievement Context

- Making welds with and without restarts.
- Given:
  - steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an FCAW welding set-up
  - a work table
  - tools and equipment
  - shielding gases
  - different types and diameters of electrode wires

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Careful choice and proper installation of components of a FCAW welding set-up. • Proper installation of electrode wire. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.

3. Prepare the work.	• Careful choice and proper installation of components of a FCAW welding set-up. • Proper installation of electrode wire. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
4. Make welds: • partial penetration on all basic joints. • full penetration on butt and fillet joints.	• Proper adjustment of welding parameters. • Appropriate use of rotary positioner. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts or blowouts – slag inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
5. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
6. Finish the job.	Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with existing procedures, if applicable. • Determination of efficient procedures, if applicable. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Appropriate use of weld gauge. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

7. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area. *For the competency as a whole:* • Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with existing procedures, if applicable. • Determination of efficient procedures, if applicable. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Appropriate use of weld gauge. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 3 to 20 mm thick.
- Hazards associated with FCAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke) (review of Competency 3).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system.
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 9).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review of competency 3).
- Data sheets for the different hazardous products used.
- Terminology used in the classification of steel: mild, low-alloy, alloy, etc. (review of Competency 9)
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of competencies 3 and 9).
- Characteristics of steel and stainless steel electrode wires: diameter, classification, etc. (review of Competency 9).
- Characteristics of gases and gas mixes: argon, CO_2, etc. (review of Competency 9).
- Expansion and contraction of steel and other metals (review of Competency 9).
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 3).
- Welding terminology: weld puddle, electric arc, joint to be welded, weld bead, welding positions 3F, 4F, 3G, 4G, etc. (review of Competency 11).

- Identification of defective couplers or welding cables (review of Competency 3).
- Detection of shielding gas leaks (review of Competency 3).
- Determination of welding procedure when there is none available.

1. Learn about the job to be done.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc. (review of Competency 9).
    - Interpretation of manufacturers' recommendations (welding set-up, electrode wires, etc.)
    - Sequence of operations and importance of compliance with checkpoints (review of Competency 9).
    - Shapes and sizes of different types of steel products, e.g. plates, structural shapes
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups (review of Competency 9).
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc. (review of Competency 9)
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing welding set-up components (constant current and voltage sensing wire feeder, constant voltage and constant-speed wire feeder) and installation methods (review of Competency 9).
    - Characteristics of flux-cored wire, rutile flux wire, basic flux wire, metal core wire and self-shielding wire for welding in all positions (review of Competency 9).
    - Criteria for choosing the electrode wire based on the procedure.
    - Cleaning of plates and welds to be repaired (e.g. oxidation, dirt) (review of Competency 9).
    - Preparation of work area (review of Competency 9).
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints)
    - Method of tack welding the assembly to reduce distortion.
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting an FCAW welding set-up: power, arc time factor, etc. (review of Competency 9).
    - Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size).
    - Gas mix used in the FCAW process.
    - Influence of gas mix on the type of filler metal transfer and on the weld bead.
    - Methods of installing the welding spool, gas cylinder, pressure regulator with flowmeter, welding gun and accessories, etc. (review of Competency 9).
    - Methods of adjusting welding set-up components and parameters.
    - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper adjustment of parts.
    - Means of removing a defective weld by CAC and PAC gouging, grinding, etc. (review of Competency 8).
    - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc. (review of Competency 9).

3. Make welds.
    - Characteristics of a quality weld bead: profile, buildup, wetting, etc.
    - Method of adjusting an FCAW welding set-up: wire speed, voltage, terminal length, arc length, etc.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
    - Characteristics of an ergonomic welding position.
    - Welding position ensuring stability throughout the process.
    - Method of obtaining quality arc strikes.
    - Welding methods, e.g. push, pull, travel angle, oscillatory motion of the welding gun, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods with rutile, basic, metal core and self-shielding electrode wires.
    - Welding methods to make a full penetration pass on a butt joint preparation.
    - Welding methods to perform a full penetration pass on a fillet joint preparation.
    - Effects of different welding sequences on the distortion of parts and assemblies.
    - Importance of welding the entire joint.
    - Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, etc.
    - Measurement of welds using a welding gauge (review of Competency 9).
    - Visual detection of the different welding defects.
    - Causes of the main welding defects.
    - Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
    - Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc. (review of Competency 11).
    - Methods of preparing fillet welding samples for a destructive test in accordance with Canadian standards (review of Competency 9).

4. Repair welds and parts.
    - Weld bead defects: crack, undercut, blowout, incomplete fusion, etc. (review of Competency 9).
    - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
    - Methods of repairing welds and broken or worn parts.

5. Finish the job.
    - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 9).
    - Method of cleaning welding set-up components (e.g. gun nozzle, welding gun conduit liner) and the work area (review of Competency 9).
    - Storage of equipment in the designated places (review of Competency 9).

Welding – Automated and Robotic Systems	Code: 804845

Competency 19 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Weld steel using automated and robotic systems.

Achievement Context

- Given:
  - steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - assemblies
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an automated SAW system
  - a GMAW or FCAW robotic cell
  - digital tools
  - jigs
  - filler metals, shielding gas and flux

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – the information on the controller – manufacturers' recommendations (e.g. for automated and robotic welding set-ups, electrode wires)

2. Prepare the work.	• Proper preparation of welds and parts to be repaired. • Careful choice and proper installation of the components of an automated system and a robotic cell. • Careful choice of electrode wires, gases and fluxes based on the procedure. • Careful inspection of safety devices on the equipment. • Proper arrangement and installation of jig. • Proper preparation of joints to be welded. • Proper positioning of parts in the jig. • Appropriate preparation of electrode wire before the arc strike.
3. Set the parameters on a robotic cell.	• Accurate positioning in the software of all movement and welding points. • Observance of data entry methods for setting parameters. • Accurate integration of welding parameters.
4. Weld using a robotic cell.	• Accurate verification and, if applicable, correction of the movement of the robotic arm. • Proper adjustment of welding parameters. • Weld bead free from defects in terms of: – position – dimensions – fusion to the part – profile – presence of undercuts and blowouts • Appropriate cleaning of welds and adjacent surfaces.
5. Weld using an automated SAW system.	• Accurate integration of welding parameters. • Weld bead free from defects in terms of: – position – dimensions – fusion to the part – profile – presence of undercuts and blowouts • Observance of methods for starting a weld bead. • Appropriate cleaning of welds and adjacent surfaces. • Appropriate use of weld gauge.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with oral or written instructions.
- Compliance with existing procedures, if applicable.
- Determination of efficient procedures, if applicable.
- Compliance with manufacturers' recommendations.
- Correct determination of sequence of operations.
- Proper choice and use of tools and equipment.
- Effective control of distortion due to welding.

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:

- Hazards associated with automated systems or robotic cells, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used (review of competencies 3 and 9).
- Advantages and disadvantages of welding using a robotic cell.
- Filler metals and shielding gas for robotic welding.
- Different parts of a robotic cell: robotic arm, rotary table or positioner, controller, control panel, etc.
- Risks related to the movement of the robotic arm and the SAW welding head: pinch zones, electrocution, handling of hot plates, handling of spools, etc.
- Basic functions of computer-aided design and drafting (CAD) software for the integration of files.
- Standard sharing and backup formats.
- Advantages and disadvantages of welding using an automated SAW system.
- Filler metals and covering flux for SAW welding.
- Criteria for choosing the electrode wire and flux for the SAW process.
- Data sheets for the different hazardous products used.
- Step down and flat transformers used in the SAW process.
- Main automated welding systems used in the industry.
- Establishment of procedures when there are none available.

1. Learn about the job to be done.
    - Specific hazards associated with a robotic cell: movement of robotic arm or part, travel speed of objects, movement zone, emergency stop, etc.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of drawings and sketches: weld dimensions, positions, etc.
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, electrode wires).
    - Sequence of operations and importance of compliance with checkpoints.

- Interpretation of standardized symbols and pictograms on welding set-ups and accessories.
- Strategies for finding information in paper and digital documents.
- Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
   - Minimum and maximum tolerances for the preparation and positioning of parts in order to obtain a satisfactory weld using an automated system or a robotic cell.
   - Choice of components of a SAW welding set-up (constant current and voltage sensing wire feeder, constant voltage and constant-speed wire feeder) and installation methods.
   - Preparation of work area.
   - Positioning of accessories: methods of installing the welding spool, gas cylinder, pressure regulator with flowmeter, welding gun and accessories, etc.
   - Positioning and alignment of jig to ensure the proper position of weld beads and to avoid contact between the robotic arm and the part or jig.
   - Installation of the components of a SAW welding set-up: flux distribution device, installation of wire, position of welding head.

3. Set the parameters on a robotic cell.
   - Integration of drawings in the robotic cell software, if applicable.
   - Functions of welding software: open, save, name and browse using different software files.
   - Functions of the robot's control panel.
   - Importation of files to set parameters.
   - Setting of parameters to simulate the movement of the robotic arm or the part to be welded: for different axes of the robot and positioner, for different types of movements and for different movement points.
   - Optimization of movement to minimize welding time.
   - Final setting of parameters for the movement of the robotic arm or part to be welded: point by point via the movement of the robotic arm or the part.
   - Movement limits and maximum capacity of the arm or the part in the welding zone.

4. Weld using a robotic cell.
   - Difference in the adjustment of settings for manual and automated welding.
   - Settings to obtain high welding speeds and avoid welding defects: type of welding gas, wire diameter, wire speed, voltage.
   - Adjustment of settings for the different welding positions: flat, horizontal, vertical and overhead.
   - Adjustment of settings for different types of joints and different types of parts made up of plates and structural shapes.
   - Adjustment of the welding torch angle to obtain the required weld bead: tilt angle in the direction of the weld and tilt angle perpendicular to the weld.
   - Different welding defects and their causes: undercuts, blowouts, sagging, incomplete fusion, etc. (review of competencies 3 and 9).
   - Adjustment of settings at the beginning and end of a bead: hot start and crater filling settings.
   - Review of cleaning of welds and adjacent surfaces (review of competencies 3, 9, 11 and 14).

5. Weld using an automated SAW system.
    - Adjustment of settings: effects (e.g. of wire speed and terminal length on intensity of current, voltage and profile of weld bead).
    - Effects of settings on profile of weld bead: penetration, width of bead, buildup.
    - Type of flux and quantity deposited on the weld bead.
    - Effects of voltage and multiple weld beads on active flux.
    - Adjustment and optimization of settings: wire-feed speed, intensity of current, voltage, travel speed.
    - Preparation of electrode wire and technique for obtaining a quality arc strike.
    - Adjustment of settings at the beginning and end of a bead: hot start and crater filling settings.
    - Cleaning of welds between passes: method of facilitating slag removal at the bottom of the bevel.
    - Mechanical methods of recovering unmelted flux and removing slag.

Assemblies of Medium Complexity	Code: 804858

Competency 20 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Produce assemblies of medium complexity.

Achievement Context

- Given:
  - steel plates and structural shapes and assemblies to be repaired or modified
  - oral or written instructions
  - assembly drawings of medium complexity
  - procedures of medium complexity
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an assembly table
  - jigs, if applicable
  - tools
  - a GMAW, FCAW or SMAW welding set-up
  - a robotic cell

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Accurate interpretation of: – oral and written instructions – drawings – procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)
2. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Determination of an efficient procedure, if applicable. • Careful choices for making a jig. • Proper creation of a jig, if applicable. • Proper determination of parts to be assembled, if applicable. • Accurate measurement of parts to be assembled.

	• Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified. • Appropriate setting of parameters of the robotic cell, if applicable.
3. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Determination of an efficient procedure, if applicable. • Careful choices for making a jig. • Proper creation of a jig, if applicable. • Proper determination of parts to be assembled, if applicable. • Accurate measurement of parts to be assembled. • Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified. • Appropriate setting of parameters of the robotic cell, if applicable.
4. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Determination of an efficient procedure, if applicable. • Careful choices for making a jig. • Proper creation of a jig, if applicable. • Proper determination of parts to be assembled, if applicable. • Accurate measurement of parts to be assembled. • Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified. • Appropriate setting of parameters of the robotic cell, if applicable.
5. Position and tack weld the parts.	• Proper positioning of jig, if applicable. • Precise positioning of each part. • Proper squaring of parts. • Appropriate orientation of parts. • Assembly method minimizing the risk of distortion during welding. • Appropriate tack welding of assembly.

6. Check the quality of the assemblies and make the necessary corrective measures.	• Thorough inspection of assemblies. • Detection of any abnormalities. • Determination of the appropriate corrective measures for identified defects. • Accurate determination of the part or parts to be moved, repaired or replaced. • Careful choice of method for removing one or more parts of the assembly. • Careful removal of the part or parts, if applicable. • Proper relocation, repair or replacement of parts.
7. Weld the assemblies manually and using a robotic cell.	• Precise assembly and adjustment of welding set-up. • Compliance with welding procedure. • Effective control of distortion. • Precise positioning of welds. • Thorough identification and correction of defects as they arise.
8. Repair or modify the assemblies.	• Observance of procedure. • Effective removal of parts or components, if applicable. • Appropriate assembly of components. • Appropriate finishing of repair.
9. Finish the job.	• Proper choice and use of finishing tools. • Careful finishing of assemblies. • Absence of damage to the parts. • Detection of any abnormalities. • Proper cleaning and storage of equipment and tools, and proper cleaning of the work area. • Recording of relevant information on the work order.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Appropriate handling and lifting of parts and assemblies. • Compliance with tolerances indicated in the drawings. • Compliance with oral or written instructions. • Compliance with existing procedures, if applicable. • Determination of efficient procedures, if applicable. • Compliance with manufacturers' recommendations. • Harmonious and effective communication.

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:

- Hazards associated with assembly work, accessories, equipment, etc. (e.g. band saw, shear, press brake) (review of competencies 5, 8, 10 and 12).
- Data sheets for the different hazardous products used.
- Importance of a clean work area (review of competencies 3 and 9).
- Tools authorized for the job.
- Precautions to take to avoid damaging parts and assemblies when working.
- Common damage: distortion, sagging of weld bead, spatter, etc.
- Methods of checking the compliance of the assembly with shape, positioning and geometric tolerances: ruler or tape measure for positioning, square for squareness, straightedge for alignment, etc. (review of competencies 3 and 9).
- Importance of communication during production.
- Consequences of poor or no communication.
- Use of digital tools for technical drawing.
- Establishment of procedures when there are none available

1. Learn about the job to be done.
    - Choice of drawings: title; project, contract and version numbers, etc. (review of Competency 13).
    - Contents of work order: order number, project number, project manager, etc. (review of Competency 13).
    - Material list: shape, dimensions, quantity, materials, etc.
    - Assembly procedure: assembly and subassembly, use of a jig, free assembly of medium complexity.
    - Distinction between isometric and orthographic projections in an assembly drawing (review of Competency 6).
    - Distinction among the different views in a drawing: front, side, top, etc. (review of Competency 6).
    - Distinction among drawings based on the views they represent (review of Competency 6).
    - Verification of instructions in the drawing: general, local and special notes (review of Competency 15).
    - Interpretation of welding procedure: procedure number, process to use, etc. (review of competencies 3 and 9).
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Characteristics of assemblies of medium complexity, for example:
        - several different parts
        - parts of different thicknesses
        - range of assembly levels
        - average tolerances of up to 2 mm for some parts of the assemblies
        - use of the following measuring instruments: tape measure, ruler, straightedge, square, protractor, level, plumb line, laser
        - use of a jig or simple assembly guide

- Characteristics of a safe work area: sufficient space to do the job, installation of screens if applicable, etc. (review of Competency 13)
- Criteria determining whether or not a jig should be made.
- Use of different methods of holding parts in a jig during manual and robotic welding.
- Preparation of work surface: assembly table, jig (review of Competency 13).
- Determination of the section of the assembly to be repaired or modified, if applicable.
- Production of a cutting list: number of parts to be cut, materials, quantity, equipment needed, specific details (e.g. straight or angular cuts) (review of Competency 13).
- Distinction among the different measuring instruments required: tape measure, square, vernier calliper, ruler, protractor, level, plumb line, laser, etc.
- Criteria for choosing measuring instruments based on the required precision, the dimensions to be measured and the type of measurement (e.g. angle, squareness, parallelism, flatness) (review of Competency 15).
- Specific characteristics of assembly tools: vises, self-locking pliers, clamps, pipe clamps, hammers, jigs, etc. (review of Competency 13).
- Method of making reference marks on the parts to be assembled (review of Competency 13).
- Choice of method for removing a section of the assembly: chisel, grinding wheel, OFC, PAC, etc.
- Methods of preparing and cleaning parts to be assembled and assemblies to be repaired or modified: cleaners, sanding, brushing, etc.
- Identification of parts using markers, punches, etc. (review of Competency 13).
- Common non-conformities of prepared parts: wrong dimensions, incorrect positioning, inappropriate machining, poor preparation, etc. (review of Competency 13).
- Verification of dimensional, positioning and geometric tolerances (review of Competency 13).
- Method of using verification tools: tape measure, ruler, square, vernier calliper, go/no go gauge (review of Competency 13).
- Arrangement of parts.

3. Position and tack weld the parts.

- Choice of assembly method based on the preparation of the parts (review of competencies 13 and 16).
- Method of using assembly tools: assembly table, self-locking pliers, clamps, vises, hammers, hinge handles, jigs.
- Marking tools: chalk, scriber, marking gauge, ruler, compass, beam compass (review of Competency 13).
- Methods of positioning parallel or perpendicular parts: parallel lines, perpendicular lines, pattern.
- Methods of positioning parts at angles other than 90 degrees: using a protractor, pattern, etc.
- Tack-welding method: determination of best place to tack weld, the size of the tack welds and the ideal number of tack welds (review of Competency 13).
- Control of distortion using tools to hold parts in place (review of Competency 13).
- Control of distortion due to the positioning of parts in opposite tilt directions (review of Competency 13).
- Assembly of plates and structural shapes.
- Methods of positioning parts based on distance, squareness, alignment or orientation.

4. Check the quality of the assemblies and make the necessary corrective measures.

- Method of verifying distances using a straightedge (review of Competency 13).
- Methods of verifying squareness using a combination square, carpenter's square, precision square, level, and the Pythagorean theorem and its reciprocal (rule of 3-4-5), etc. (review of Competency 4).
- Method of verifying flatness and parallelism using a tape measure and straightedge, a tape measure and square, etc. (review of Competency 13).

- Method of verifying a part positioned at an angle: using a square to verify the slope, a protractor to verify the angle, and mathematical calculations.
- Method of verifying positioning using a go/no go gauge.
- Verification of the flatness of a work surface (review of Competency 13).
- Criteria for choosing a method of removing one or more parts from an assembly based on the accessibility of the tack weld, the position and rigidity of the part and the amount of weld to be removed (review of Competency 13).
- Choice of method for removing one or more parts from an assembly: chisel, grinder or thermal cutting process (review of Competency 13).
- Method of gouging and cutting a tack weld in an assembly.
- Method of cleaning a repaired part (review of Competency 13).

5. Weld the assemblies manually and using a robotic cell.
   - Determination of welding sequence for parts based on the type of assembly and the required dimensions and depths of the weld beads (review of Competency 13).
   - Setting of parameters of a robotic system (review of Competency 19).
   - Welding method based on the welding procedure, the accessibility of the joint to be welded and the ability to control distortion of the assembly (review of Competency 13).
   - Determination of welds to be made first in anticipation of limited access, in order to reduce distortion, etc. (review of Competency 13).
   - Weld bead defects related to their dimensions, regularity, fusion to the part, profile, presence of undercuts or blowouts or, if applicable, slag inclusion (review of Competency 13).
   - Method of gouging and cutting a weld in an assembly: determination of path of cutting stream to avoid damaging the assembly or causing injury, use of a method to avoid contact between the carbon electrode and the assembly, use of additional protective equipment (review of Competency 13).
   - Method of cleaning a repaired part (review of Competency 13).

6. Repair or modify the assemblies.
   - Choice of method for straightening an assembly or section of an assembly: cold forging, hot forging.
   - Method of adjusting and assembling repaired components.
   - Method of finishing a repaired assembly: choice of finishing grain (grinding or sanding) to obtain a uniform surface.

7. Finish the job.
   - Choice and use of finishing tools: grinding wheel on a portable grinder, sandpaper on a portable grinder, etc. (review of Competency 13).
   - Methods of reducing the number of marks and scratches on a welded assembly (review of Competency 13).
   - Tools for cleaning assemblies: chipping hammer, metal brush, scraper, chisel, file, grinder, sander, etc. (review of Competency 13).
   - Removal of spatter on the surface of the assembly, the jig and the tools used (review of Competency 13).
   - Removal of tack welds used to hold the parts temporarily in place on the surface and on the jig (review of Competency 13).
   - Recording of information on the order form for production monitoring: steps completed, by whom, when, etc. (review of Competency 13).

Welding of Steel and Stainless Steel (GTAW) – All Four Positions	Code:	804866

Competency 21 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency

Weld steel and stainless steel using the GTAW process in all four positions.

Achievement Context

- When making welds:
  - using the GTAW and GTAW-P processes
  - with and without restarts
- Given:
  - steel and stainless steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - GTAW and GTAW-P welding set-ups
  - a work table
  - a purge system
  - tools and equipment
  - shielding gases
  - rods of different types and diameters
  - a rotary positioner

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings – welding procedures – the repair to be done – manufacturers' recommendations (e.g. for the welding set-up, rods)

2. Prepare the work.	• Careful choice and proper installation of components of a GTAW welding set-up. • Appropriate choice and preparation of the non-consumable electrode. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
3. Make welds: • full and partial penetration welds on all basic joints on steel. • partial penetration welds on all basic joints on stainless steel. • full penetration welds on butt joints on stainless steel.	• Proper adjustment of welding parameters. • Appropriate use of rotary positioner. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts or blowouts – metallic inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with oral or written instructions.
- Compliance with existing procedures, if applicable.
- Determination of efficient procedures, if applicable.
- Compliance with manufacturers' recommendations.
- Correct determination of sequence of operations.
- Proper choice and use of tools and equipment.
- Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 1 to 7 mm thick.
- Welding of stainless steel, e.g. parts 1 to 4 mm thick.
- Hazards associated with GTAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system.
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review of competency 3).
- Terminology used in the classification of steel: mild, low-alloy, alloy, stainless, etc. (review of Competency 3)
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of Competency 3)
- Characteristics of mild steel and stainless steel rods: size, classification, etc. (review of Competency 3)
- Characteristics of gases and gas mixes: argon, helium, hydrogen.
- Expansion and contraction (review of Competency 3).
- Specific characteristics of GTAW welding set-ups depending on the manufacturer.
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, high frequency, etc.
- Pulse current parameters: peak current, basic current, pulse frequency, etc.
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G (review of competencies 3 and 11).
- Identification of defective couplers or welding cables: stripped cable, gas leak, water leak.
- Establishment of procedures when there are none available.

Welding of Steel and Stainless Steel (GTAW) – All Four Positions	Code:	804866

1. Learn about the job to be done.
    - Zones and different steps in the process.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, rods).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of steel and stainless steel products, e.g. plates, structural shapes (review of Competency 3).
    - Representation of standardized symbols and pictograms, e.g. on welding set-ups.
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing welding set-up components and installation method.
    - Criteria for choosing the filler metal based on the procedure.
    - Criteria for choosing non-consumable electrodes.
    - Cleaning of plates (e.g. oxidation, dirt).
    - Preparation of work area.
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
    - Role of tack welding in reducing distortion.
    - Installation of a purge dam device: holding of parts, flow adjustment.
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting a GTAW welding set-up.
    - Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size).
    - Methods of installing the non-consumable electrode, gas cylinder, pressure regulator with flowmeter, water- or gas-cooled welding torch and accessories, etc.
    - Methods of adjusting welding set-up components and parameters.
    - Type of purging and adjustment.
    - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper adjustment of parts.
    - Review of methods of removing defective welds by CAC and PAC gouging, grinding, etc. (review of competencies 5 and 8).
    - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc. (review of competencies 5 and 8).

3. Make welds.
    - Method of adjusting a GTAW welding set-up: current, polarity, arc length, etc.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 200 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead
    - Welding position to ensure stability throughout the welding process with and without filler metal.
    - Method of obtaining quality arc strikes: friction, high frequency, etc.
    - Welding methods, e.g. travel angle, oscillatory motion of the welding torch, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods.

- Welding methods to perform a full penetration pass on a butt joint preparation with gap, using a purge dam device and support.
- Use of an inert gas chamber: advantages, disadvantages, etc.
- Effects of different welding sequences on the distortion of parts and assemblies.
- Importance of welding the entire joint.
- Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, metallic inclusion, etc.
- Visual detection of the different welding defects.
- Causes of the main welding defects.
- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Cleaning of welds and adjacent surfaces using wire brushes, sandpaper, chemical and electrical cleaning equipment, etc.

4. Repair welds and parts.
   - Weld bead defects: crack, undercut, blowout, incomplete fusion, etc.
   - Review of methods of removing defective welds by CAC and PAC gouging and grinding (review of competencies 5 and 8).
   - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, tungsten inclusion, etc.
   - Methods of repairing welds and broken or worn parts.
   - Type of support for maintaining the weld puddle during the repair.

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc.
   - Method of cleaning the welding set-up components (e.g. nozzle, collar, gas diffuser) and the work area.
   - Storage of equipment in the designated places.

Welding of Steel (SMAW) – Vertical and Overhead Positions	Code: 804875

Competency 22 Duration 75 hours Credits 5

Behavioural Competency

Statement of the Competency

Weld steel using the SMAW process in the vertical and overhead positions.

Achievement Context

- Making welds with and without restarts.
- Given:
  - steel plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - a SMAW welding set-up
  - a work table
  - tools and equipment
  - different types and diameters of coated electrodes

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, coated electrodes)
2. Prepare the work.	• Careful choice and proper installation of SMAW welding set-up components. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.

3. Prepare the work.	• Careful choice and proper installation of SMAW welding set-up components. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
4. Make welds: • partial penetration on all basic joints. • full penetration on butt and corner joints.	• Proper adjustment of welding parameters. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts or blowouts – slag inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
5. Repair welds and parts.	• Proper determination of welding procedure. • Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
6. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.
	For the competency as a whole:
	• Compliance with occupational health and safety rules. • Compliance with oral or written instructions. • Compliance with existing procedures, if applicable. • Determination of efficient procedures, if applicable. • Compliance with manufacturers' recommendations. • Correct determination of sequence of operations. • Appropriate use of weld gauge. • Proper choice and use of tools and equipment. • Effective control of distortion due to welding.

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:

- Welding of steel, e.g. parts 1 to 10 mm thick.
- Hazards associated with SMAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke) (review of Competency 14).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system.
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 14).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 14).
- Terminology used in the classification of steel: mild, low-alloy, alloy, etc. (review of Competency 3)
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of Competency 17).
- Characteristics of steel-coated electrodes: size, classification, etc.
- Method of storing the different types of coated electrodes (review of Competency 14).
- Expansion and contraction of steel and other metals (review of Competency 14).
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 14)
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 3F, 4F, 3G, 4G, etc. (review of Competency 14)
- Identification of defective couplers or welding cables (review of Competency 14).
- Establishment of procedures when there are none available.

1. Learn about the job to be done.
    - Zones and different steps in the process (review of Competency 14).
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc. (review of Competency 14).
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, coated electrodes).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of steel products, e.g. plates, structural shapes (review of Competency 3).
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups (review of Competency 14).
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc. (review of Competency 14).
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing components of a constant-current welding set-up and installation method (review of Competency 14).
    - Characteristics of coated electrodes: types of flux, welding parameters.
    - Criteria for choosing the appropriate coated electrode.
    - Cleaning of plates and welds to be repaired (e.g. oxidation, dirt) (review of Competency 14).
    - Preparation of work area (review of Competency 14).
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints) (review of Competency 18).
    - Role of tack welding in reducing distortion (review of Competency 18).
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting a SMAW welding set-up: power, arc time factor, etc. (review of Competency 14).
    - Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size) (review of Competency 17).
    - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper adjustment of parts (review of Competency 18).
    - Methods of removing defective welds by CAC and PAC gouging, grinding, etc. (review of competencies 5 and 8).
    - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc. (review of Competency 18).

3. Make welds.
    - Method of adjusting a SMAW welding set-up: hot start, adjustment of voltage current slope, remote control.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
    - Characteristics of an ergonomic welding position.
    - Welding position ensuring stability throughout the process.
    - Method of obtaining quality arc strikes.
    - Welding methods, e.g. travel angle, oscillatory motion of the coated electrode, arc length, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods with rutile-coated, cellulose-coated and basic-coated electrodes.
    - Welding methods to perform a full penetration pass on a butt joint preparation with gap.
    - Effects of different welding sequences on the distortion of parts and assemblies (review of Competency 14).
    - Importance of welding the entire joint (review of Competency 14).
    - Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, slag inclusion, etc. (review of Competency 14).
    - Measurement of welds using a welding gauge (review of Competency 3).
    - Visual detection of the different welding defects (review of Competency 14).
    - Causes of the main welding defects.
    - Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion

- Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc. (review of Competency 14).
- Methods of preparing butt and fillet welding samples for a destructive test in accordance with Canadian standards (review of Competency 18).

4. Repair welds and parts.
   - Weld bead defects: crack, undercut, blowout, incomplete fusion, etc.
   - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
   - Methods of repairing welds and broken or worn parts (review of Competency 9).
   - Type of support for maintaining the weld puddle during the repair.

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 14).
   - Method of cleaning welding set-up components and the work area (review of Competency 14).
   - Storage of equipment in the designated places (review of Competency 14).

Welding of Aluminum (GMAW) – All Four Positions	Code: 804884

Competency 23 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

Weld aluminum using the GMAW process in all four positions.

Achievement Context

- When making welds:
  - using the GMAW and GMAW-P processes
  - with and without restarts
- Given:
  - aluminum plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - GMAW and GMAW-P welding set-ups
  - a work table
  - tools and equipment
  - shielding gases
  - different types and diameters of electrode wires
  - a rotary positioner

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – manufacturers' recommendations (e.g. for the welding set-up, electrode wires)

2. Prepare the work.	• Careful choice of welding set-up. • Careful choice of wire feeder. • Proper preparation of joints to be welded. • Proper installation of electrode wire. • Proper installation of shielding-gas supply system. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
3. Make welds: • partial penetration on all basic joints. • full penetration on butt and corner joints.	• Proper adjustment of welding parameters. • Appropriate use of the different transfer modes in electric arc welding: short circuit, globular, spray and pulsed spray. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts, blowouts or oxidation – metallic inclusion • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Repair welds and parts.	• Proper repair of welds and parts. • Proper buildup of parts to be resurfaced.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with oral or written instructions.
- Compliance with photographs, drawings, etc.
- Compliance with existing procedures, if applicable.
- Determination of efficient procedures, if applicable.
- Compliance with manufacturers' recommendations.
- Correct determination of sequence of operations.
- Proper choice and use of tools and equipment.
- Effective control of distortion due to welding.

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:

- Welding of aluminum, e.g. parts 1 to 10 mm thick.
- Hazards associated with GMAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke) (review of Competency 3).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system.
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review).
- Characteristics of an ergonomic welding position.
- Terminology used in the classification of aluminum.
- Basic mechanical properties of metals: tensile strength, yield strength, ductility, etc. (review of Competency 3).
- Characteristics of aluminum electrode wires: diameter, classification, etc.
- Characteristics of gases and gas mixes: argon, helium.
- Expansion and contraction of aluminum.
- Basic principles of an electrical circuit: current flow, polarity, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 3).
- Welding terminology: weld puddle, electric arc, joint, weld bead, welding positions 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G (review of competencies 3 and 11).
- Location of defective couplers or welding cables.
- Detection of shielding gas leaks (review of Competency 3).
- Establishment of procedures when there are none available.

Welding of Aluminum (GMAW) – All Four Positions Code: 804884

1. Learn about the job to be done.
    - Zones and different steps in the process.
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Interpretation of manufacturers' recommendations (e.g. for the welding set-up, electrode wires).
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of aluminum products, e.g. plates, structural shapes.
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups.
    - Information about the repair to be done: cracks, porosity, profile, dimensions, depth, etc.
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing welding set-up components (welding set-up and type of wire feeder) and installation method.
    - Criteria for choosing the electrode wire based on the procedure.
    - Cleaning of plates (e.g. oxidation, dirt) (review of Competency 5).
    - Preparation of work area for welding aluminum parts .
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
    - Tack-welding method aimed at reducing distortion and avoiding overly fragile tack welds.
    - Methods of removing defective welds by CAC and PAC gouging, grinding, etc. (review of competencies 5 and 8).
    - Method of repairing a weld with a defect: crack, perforation, undercut, blowout, slag inclusion, etc.

3. Make welds.
    - Characteristics of a quality weld bead: dimensions, buildup, wetting, etc.
    - Method of adjusting a GMAW welding set-up: wire speed, voltage, terminal length, arc length, etc.
    - Method of adjusting a GMAW-P welding set-up.
    - Method of obtaining a regular weld on straight and circular joints.
    - Information about regularity, e.g. welds over a length of 300 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
    - Welding position ensuring stability throughout the process.
    - Method of obtaining quality arc strikes.
    - Distinction among the different transfer modes: short circuit, globular, spray and pulsed spray.
    - Welding methods, e.g. push, pull, travel angle, oscillatory motion of the welding gun, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods.
    - Welding methods to perform a full penetration pass on a butt joint preparation.
    - Welding methods to perform a full penetration pass on a fillet joint preparation.
    - Effects of different welding sequences on the distortion of parts and assemblies.
    - Importance of welding the entire length of the joint.
    - Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, weld bead oxidation, etc.
    - Measurement of welds using a welding gauge (review of Competency 3).
    - Visual detection of the different welding defects.
    - Causes of the main welding defects.

- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Cleaning of welds and adjacent surfaces using a chipping hammer, wire brush, chisel, scraper, file, etc.
- Methods of preparing fillet welding samples for a destructive test in accordance with Canadian standards.

4. Repair welds and parts.
   - Review of weld bead defects: crack, undercut, blowout, incomplete fusion, etc.
   - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
   - Type of support for maintaining the weld puddle during the repair.

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 3).
   - Method of cleaning the welding set-up components (e.g. nozzle, collar, gas diffuser) and the work area.
   - Storage of equipment in the designated places (review of Competency 3).

Welding of Aluminum (GTAW) – All Four Positions	Code: 804894

Competency 24 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

Weld aluminum using the GTAW process in all four positions.

Achievement Context

- When making welds:
  - using the GTAW and GTAW-P processes
  - with and without restarts
- Given:
  - aluminum plates, structural shapes and cylindrical parts of different thicknesses, both regular and irregular in shape
  - welds and parts to be repaired
  - oral and written instructions
  - drawings and sketches
  - welding procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - GTAW and GTAW-P welding set-ups
  - a work table
  - tools and equipment
  - rods of different types and diameters
  - a rotary positioner

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Correct interpretation of: – oral and written instructions – drawings and sketches – welding procedures – the repair to be done – manufacturers' recommendations (e.g. for the welding set-up, rods)

2. Prepare the work.	• Careful choice and proper installation of welding set-up components. • Appropriate choice and preparation of non-consumable electrode. • Proper preparation of joints to be welded. • Accurate setting of tack-welding parameters. • Proper adjustment of parts to be tack-welded (butt and fillet welds). • Appropriate tack welding of parts. • Careful choice of method for preparing welds and parts to be repaired. • Proper preparation of welds and parts to be repaired.
3. Make welds: • partial penetration on all basic joints • full penetration on butt and corner joints	• Proper adjustment of welding parameters. • Appropriate use of rotary positioner. • Observance of methods for starting a weld bead. • Weld bead free from defects in terms of: – dimensions – regularity – fusion to the part – profile – presence of undercuts or blowouts – metallic inclusion • Precise welding at joint restarts. • Appropriate cleaning of welds and adjacent surfaces. • Thorough detection of all visible defects. • Careful correction of defects detected.
4. Repair welds and parts.	• Proper determination of welding procedure. • Careful choice of method for preparing welds. • Proper preparation of part to be welded. • Proper repair of weld. • Proper buildup of part to be resurfaced.
5. Finish the job.	• Proper cleaning and storage of equipment and tools, and proper cleaning of the work area.

For the competency as a whole:

- Compliance with occupational health and safety rules.
- Compliance with oral or written instructions.
- Compliance with existing procedures, if applicable.
- Determination of efficient procedures, if applicable.
- Compliance with manufacturers' recommendations.
- Correct determination of sequence of operations.
- Proper choice and use of tools and equipment.
- Effective control of distortion due to welding.

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:

- Welding of aluminum, e.g. parts 1 to 10 mm thick.
- Hazards associated with GTAW welding set-ups, accessories, equipment, etc. (e.g. electrification, electrocution, hot parts, pinch zones, handling of hot plates, handling of spools, spatter, smoke).
- Data sheets for the different hazardous products used.
- Adjustment of the position of the part or fume and gas exhaust system (review of Competency 3).
- Use of personal protective equipment (PPE): criteria for choosing protective clothing (e.g. welding jacket, welding gloves, work gloves) and welding mask (positioning of headband, adjustment of electronic functions and fume filters) (review of Competency 3).
- Personal and collective protective measures against burns caused by arc rays, hot parts and welding spatter (review of Competency 3).
- Storage, transportation and installation of gas cylinders (review of competency 3).
- Terminology used in the classification of aluminum alloys: Alloy 1100, 6061-T6, etc. (review of Competency 23).
- Basic mechanical properties of aluminum alloys: corrosion resistance, electrical and thermal conductivity, tensile strength, yield strength, ductility (review of Competency 23).
- Characteristics of aluminum rods: format, classification, etc. (review of Competency 23)
- Characteristics of argon, helium and their mixes.
- Expansion and contraction (review of Competency 23).
- Basic principles of an electrical circuit: current flow, direct current, alternating current, electrical resistance, inductance, etc. (review of Competency 21)
- Pulse current parameters: peak current, basic current, pulse frequency, etc.
- Welding terminology: weld puddle, electric arc, joint to be welded, weld bead, welding positions 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G (review).
- Identification of defective couplers or welding cables: stripped cable, gas leak, water leak (review of Competency 21).
- Establishment of procedures when there are none available.

Welding of Aluminum (GTAW) – All Four Positions	Code:	804894

1. Learn about the job to be done.
    - Zones and different steps in the process (review of Competency 21).
    - Interpretation of welding procedures: type of joint, welding position, filler metals, arrangement of weld beads, welding parameters, etc.
    - Sequence of operations and importance of compliance with checkpoints.
    - Shapes and dimensions of the different types of aluminum products, e.g. plates, structural shapes.
    - Interpretation of standardized symbols and pictograms, e.g. on welding set-ups (review of Competency 21).
    - Strategies for finding information in paper and digital documents.
    - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
    - Criteria for choosing welding set-up components and installation method (review of Competency 21).
    - Criteria for choosing the filler metal based on the procedure.
    - Criteria for choosing non-consumable electrodes.
    - Cleaning of plates (e.g. oxidation, dirt).
    - Preparation of work area.
    - Use of method for assembling basic joints (T, butt, edge, corner and lap) to ensure precise, quality work (e.g. gaps between the plates, regularity of the joints).
    - Role of tack welding in reducing distortion.
    - Arrangement of welding equipment to allow for fluid welding movement.
    - Positioning of assembly to facilitate welding.
    - Method of selecting a GTAW welding set-up to weld aluminum.
    - Types of filler metals used in the industry: brand name and classification according to Canadian and U.S. standards (e.g. diameter, size) (review of Competency 23).
    - Methods of preparing and installing the non-consumable electrode, gas cylinder, pressure regulator with flowmeter, water- or gas-cooled welding torch and accessories, etc.
    - Methods of adjusting welding set-up components and parameters.
    - Methods of assembling basic joints: holding parts to control distortion, tack-welding sequence to ensure the proper adjustment of parts.

3. Make welds.
    - Method of adjusting a GTAW welding set-up: current, polarity, arc length, etc.
    - Method of obtaining a regular weld on straight and circular joints (review of Competency 21).
    - Information about regularity, e.g. welds over a length of 200 mm, with tolerances of approximately 10% for the width, 10% for the height and 2 mm for the straightness of the bead.
    - Welding position to ensure stability throughout the welding process with and without filler metal
    - Method of obtaining quality arc strikes: friction, high frequency, etc.
    - Welding methods, e.g. travel angle, oscillatory motion of the welding gun, travel speed.
    - Method of welding at joint restarts.
    - Single-bead and multiple-bead welding methods.
    - Welding methods to perform a full penetration pass on a butt joint preparation with gap, using a purge dam device and support.
    - Effects of different welding sequences on the distortion of parts and assemblies.
    - Importance of welding the entire length of the joint (review of Competency 21).

- Welding defects caused by the welder: undercut, porosity, inadequate profile of weld bead, incomplete penetration, sagging, metallic inclusion, etc. (review of competencies 21 and 23).
- Visual detection of the different welding defects: oxidation, tungsten inclusion, cracks, porosity, etc.
- Causes of the main welding defects.
- Methods of correcting the beginning and end of an incomplete weld bead and lack of fusion.
- Cleaning of welds and adjacent surfaces using stainless steel wire brushes, sandpaper, chemical cleaning equipment, etc.

4. Repair welds and parts.
   - Methods of removing defective welds by CAC and PAC gouging and grinding (review of competencies 5 and 8).
   - Method of making a uniform weld on a joint that has been gouged or ground: beginning and end at the appropriate locations.
   - Methods of repairing welds and broken or worn parts.
   - Type of support for maintaining the weld puddle during the repair.

5. Finish the job.
   - Shutdown of welding set-up and other equipment, disconnection of power source, etc. (review of Competency 21).
   - Method of cleaning the welding set-up components (e.g. nozzle, collar, gas diffuser) and the work area (review of Competency 21).
   - Storage of equipment in the designated places (review of Competency 21).

Complex Assemblies	Code: 804908

Competency 25 Duration 120 hours Credits 8

Behavioural Competency

Statement of the Competency

Produce complex assemblies.

Achievement Context

- Given:
  - steel plates and structural shapes and assemblies to be repaired or modified
  - oral or written instructions
  - complex assembly drawings
  - complex procedures
  - manufacturers' recommendations
- Using:
  - personal and collective protective measures
  - an assembly table
  - jigs, if applicable
  - tools and equipment
  - a GMAW, FCAW, SMAW or GTAW welding set-up
  - an automated or robotic system

Elements of the Competency	Performance Criteria
1. Learn about the job to be done.	• Effective information search. • Relevant information gathered. • Accurate interpretation of: – oral and written instructions – drawings – procedures – manufacturers' recommendations (e.g. for the welding set-up, rods)

Complex Assemblies	Code: 804908
2. Prepare the work.	• Proper preparation of work area. • Production of a complete cutting list. • Careful choice of tools and measuring instruments. • Determination of an efficient procedure, if applicable. • Careful choices for making a jig. • Proper creation of a jig, if applicable. • Proper determination of parts to be assembled, if applicable. • Accurate measurement of parts to be assembled. • Accurate calculation of positioning of parts. • Proper preparation of parts to be assembled and assemblies to be repaired or modified. • Appropriate setting of parameters of the robotic cell, if applicable.
3. Position and tack weld the parts.	• Proper positioning of jig, if applicable. • Precise positioning of each part. • Proper squaring of parts. • Appropriate orientation of parts. • Assembly method minimizing the risk of distortion during welding. • Appropriate tack welding of assembly.
4. Check the quality of the assemblies and make the necessary corrective measures.	• Thorough inspection of assemblies. • Detection of any abnormalities. • Determination of the appropriate corrective measures for identified defects. • Accurate determination of the part or parts to be moved, repaired or replaced. • Careful choice of method for removing one or more parts of the assembly. • Careful removal of the part or parts, if applicable. • Proper relocation, repair or replacement of parts.
5. Weld the assemblies manually and using a robotic cell.	• Precise assembly and adjustment of welding set-up. • Compliance with welding procedure. • Effective control of distortion. • Precise positioning of welds. • Perfect bead. • Thorough identification and correction of defects as they arise.

6. Repair or modify the assemblies.	• Determination of an efficient procedure. • Observance of procedure. • Effective removal of parts or components, if applicable. • Appropriate assembly of components. • Appropriate finishing of repair.
7. Finish the job.	• Proper choice and use of finishing tools. • Careful finishing of assemblies. • Absence of damage to the parts. • Detection of any abnormalities. • Proper cleaning and storage of equipment and tools, and proper cleaning of the work area. • Recording of relevant information on the work order.
	For the competency as a whole: • Compliance with occupational health and safety rules. • Appropriate handling and lifting of parts and assemblies. • Compliance with tolerances indicated in the drawings. • Compliance with oral or written instructions. • Compliance with existing procedures, if applicable. • Determination of efficient procedures, if applicable. • Compliance with manufacturers' recommendations. • Harmonious and effective communication.

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:

- Hazards associated with assembly work, accessories, equipment, etc. (e.g. band saw, shear, press brake) (review of competencies 5, 8, 10 and 12).
- Data sheets for the different hazardous products used.
- Importance of a clean work area (review of Competency 20).
- Authorized work tools (review of Competency 20).
- Precautions to take to avoid damaging parts and assemblies when working (review of Competency 20).
- Common damage: distortion, sagging of weld bead, spatter, etc. (review of Competency 20).
- Methods of checking the compliance of the assembly with shape, positioning and geometric tolerances: ruler or tape measure for positioning, square for squareness, straightedge for alignment, etc. (review of Competency 20).

- Importance of communication during production.
- Consequences of poor or no communication.
- Use of digital tools for technical drawing.
- Establishment of procedures when there are none available

1. Learn about the job to be done.
   - Choice of drawings: title; project, contract and version numbers, etc. (review of Competency 20)
   - Contents of work order: order number, project number, project manager, etc. (review of Competency 20)
   - Material list: shape, dimensions, quantity, materials, etc. (review of Competency 20)
   - Assembly procedure: assembly and subassembly, use of a jig, free assembly.
   - Distinction between isometric and orthographic projections (review of Competency 15).
   - Distinction among the different views in a drawing: front, side, top, etc. (review of Competency 15)
   - Distinction among drawings based on the views they represent (review of Competency 15).
   - Verification of instructions in the drawing: general, local and special notes (review of Competency 15).
   - Interpretation of welding procedure: procedure number, process to use, etc.
   - Strategies for finding information in paper and digital documents.
   - Consultation of digital reference documents: work orders, drawings and sketches, procedures, instructions, etc.

2. Prepare the work.
   - Characteristics of complex assemblies, for example:
     - several different parts
     - parts of different thicknesses
     - range of assembly angles
     - positioning of different parts on cylindrical or conical parts
     - low tolerances of up to 1 mm for some parts of the assembly
     - use of the following measuring instruments: tape measure, ruler, straightedge, protractor, level, plumb line, laser
     - minimal use of jig
   - Characteristics of a safe work area: sufficient space to do the job, installation of screens if applicable, etc. (review of Competency 20).
   - Criteria determining whether or not a jig should be made.
   - Use of different methods of holding parts in a jig during manual and robotic welding (review of Competency 20).
   - Preparation of work surface: assembly table, jig (review of Competency 20).
   - Determination of the section of the assembly to be repaired or modified, if applicable
   - Production of a cutting list: number of parts to be cut, materials, quantity, equipment needed, specific details (e.g. straight or angular cuts) (review of Competency 20).
   - Method of monitoring the work done (review of Competency 20).
   - Distinction among the different measuring instruments required: tape measure, square, vernier calliper, ruler, etc. (review of Competency 20).
   - Criteria for choosing measuring instruments based on the required precision, the dimensions to be measured and the type of measurement (e.g. angle, squareness, parallelism, flatness) (review of Competency 20).
   - Specific characteristics of assembly tools: vises, self-locking pliers, clamps, pipe clamps, hammers, jigs, etc.(review of Competency 20)
   - Choice of method of removing a section of the assembly: chisel, grinding wheel, OFC, PAC, etc.
   - Methods of preparing and cleaning parts to be assembled and assemblies to be repaired or modified: cleaners, sanding, brushing, etc.

- Method of making reference marks on the parts to be assembled (review of competencies 13, 16 and 20).
- Identification of parts using markers, punches, etc. (review of Competency 20)
- Common non-conformities of prepared parts: wrong dimensions, incorrect positioning, inappropriate machining, poor preparation, etc. (review of Competency 20)
- Verification of dimensional, positioning and geometric tolerances (review of Competency 20)
- Verification of cylindrical parts: diameter, cylindricity, etc.
- Method of using verification tools: tape measure, ruler, square, vernier calliper, go/no go gauge (review of Competency 20).
- Arrangement of parts.

3. Position and tack weld the parts.
   - Choice of assembly method based on the preparation of the parts (review of competencies 13, 16 and 20).
   - Method of using assembly tools: assembly table, self-locking pliers, clamps, vises, hammers, hinge handles, jigs (review of Competency 20).
   - Marking tools: chalk, scriber, marking gauge, ruler, compass, beam compass (review of Competency 20).
   - Methods of positioning parallel or perpendicular parts: parallel lines, perpendicular lines and pattern (review of Competency 20).
   - Methods of positioning parts at angles other than 90 degrees: using a protractor, pattern, etc. (review of Competency 20).
   - Methods of positioning different cylindrical parts: longitudinal, circumferential and angular positioning.
   - Tack-welding method: determination of best place to tack weld, the size of the tack welds and the ideal number of tack welds.
   - Control of distortion using tools to hold parts in place.
   - Control of distortion due to the positioning of parts in opposite tilt directions.
   - Assembly of plates and structural shapes.
   - Methods of positioning parts based on distance, squareness, alignment or orientation (review of Competency 20).

4. Check the quality of the assemblies and make the necessary corrective measures.
   - Method of verifying distances using a straightedge (review of Competency 13)
   - Methods of verifying squareness using a combination square, carpenter's square, precision square, level, and the Pythagorean theorem (rule of 3-4-5), etc.
   - Methods of verifying the positioning of parts on a cylindrical part: using a tape measure, level, plumb line, etc.
   - Method of verifying flatness and parallelism using a tape measure and straightedge, a tape measure and square, etc.
   - Method of verifying a part positioned at an angle: using a square to verify the slope, a protractor to verify the angle, and mathematical calculations.
   - Method of verifying positioning using a go/no go gauge.
   - Method of verifying the flatness of a work surface (review of Competency 20).
   - Criteria for choosing a method of removing one or more parts from an assembly based on the accessibility of the tack weld, the position and rigidity of the part and the amount of weld to be removed (review of Competency 20).
   - Choice of method for removing one or more parts from an assembly: chisel, grinder or thermal cutting process (review of competencies 5 and 8).
   - Method of gouging and cutting a tack weld in an assembly (review of Competency 20).
   - Method of cleaning a repaired part (review of Competency 20).

5. Weld the assemblies manually and using a robotic cell.
    - Determination of welding sequence for parts based on the type of assembly and the required dimensions and depths of the weld beads (review of Competency 20).
    - Setting of parameters of a robotic system (review of Competency 19).
    - Welding method based on the welding procedure, the accessibility of the joint to be welded and the ability to control distortion of the assembly (review of Competency 20).
    - Determination of welds to be made first in anticipation of limited access, in order to reduce distortion, etc. (review of Competency 20)
    - Weld bead defects related to their dimensions, regularity, fusion to the part, profile, presence of undercuts or blowouts or, if applicable, slag inclusion (review of Competency 20).
    - Method of gouging and cutting a weld in an assembly: determination of path of cutting stream to avoid damaging the assembly or causing injury, use of a method to avoid contact between the carbon electrode and the assembly, use of additional protective equipment (review of Competency 20).
    - Method of cleaning a repaired part (review of Competency 20).

6. Repair or modify the assemblies.
    - Choice of method for straightening an assembly or section of an assembly: cold forging, hot forging.
    - Method of adjusting and assembling repaired components.
    - Method of finishing a repaired assembly: choice of finishing grain (grinding or sanding) to obtain a uniform surface.

7. Finish the job.
    - Choice and use of finishing tools: grinding wheel on a portable grinder, sandpaper on a portable grinder, etc. (review of Competency 20)
    - Methods of reducing the number of marks and scratches on a welded assembly (review of Competency 20).
    - Tools for cleaning assemblies: chipping hammer, metal brush, scraper, chisel, file, grinder, sander, etc. (review of Competency 20)
    - Removal of spatter on the surface of the assembly, the jig and the tools used (review of Competency 20).
    - Removal of tack welds used to hold the parts temporarily in place on the surface and on the jig (review of Competency 20).
    - Recording of information on the order form for production monitoring: steps completed, by whom, when, etc. (review of Competency 20)

Career Development	Code: 804911

Competency 26 Duration 15 hours Credits 1

Situational Competency

Statement of the Competency

Manage their career.

Elements of the Competency

- Determine their career goals.
- Engage in a job search process.

Learning Context

Information Phase

- Learning about job opportunities in welding and assembly.
- List the work experience, skills and attitudes required for the job they want.
- Learning about the steps in the job search process.
- Learning about the tools used to apply for a job.

Participation Phase

- Reflecting on their preferences and interest in various career paths in welding and assembly.
- Taking part in real or simulated interviews with a potential employer.
- Determining the attitudes 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 (by phone or in person) and attending a hiring interview.

Instructional Guidelines

- Create an environment conducive to reflecting on and exploring possible career paths.
- Facilitate discussions on possible career paths.
- Encourage students to identify their interests, skills and aptitudes.
- Organize realistic simulation exercises in welding and assembly.
- Provide sample job search tools representative of welding and assembly.

Career Development	Code: 804911

Participation Criteria

Information Phase

- Learn about the topics covered.
- Make a list of their work experience, skills and aptitudes applicable to the job they want.

Participation Phase

- Participate in the suggested activities.
- Make a list of possible jobs based on their interests and preferences.
- Produce job search tools.

Synthesis Phase

- Make a list of their strengths and areas requiring improvement, and 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 the competency as a whole and to each phase of the learning context, along with their attendant guidelines.

For the competency as a whole:

- Digital job search tools .

Information Phase

- Job opportunities in welding and assembly.
- Consultation of resources such as employment centres, employment agencies, local newspapers, the Internet, etc.
- Steps in the job search process in welding and assembly: definition of interests, applications, formal and informal interviews, practical exams, 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 various types of careers in welding and assembly.
- Types of job status: employee, self-employed worker, etc.
- Future prospects (e.g. team leader, foreperson, inspector)
- Assessment of their strengths and weaknesses in meetings with potential employers.
- Attitudes to adopt in an interview: dress, language, etc.
- Distance communication: introduction, protocol, tone of voice and language level, polite expressions.
- Production of job search tools (e.g. letter, business card, resumé).
- Rules of writing.

Synthesis Phase

- Determination of their strengths and areas requiring improvement in terms of job search, and means of improvement.
- Self-assessment, comments gathered during simulation exercises or practicums, etc.

Entering the Work Force	Code: 804926

Competency 27 Duration 90 hours Credits 6

Situational Competency

Statement of the Competency

Enter the work force.

Elements of the Competency

- Apply competencies learned 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 of the practicum.
- Learning about the contents of a log.
- Learning about the type of production in the company and the rules and practices in effect.

Participation Phase

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

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 in the host company on ways of fostering the performance of trade-related tasks and the development of students' autonomy.
- Maintain close collaboration with the practicum supervisors in the host company.
- Make sure trainees are properly supervised.
- Regularly visit students in the workplace.
- 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 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 the competency as a whole and 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: headers, 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 how previous practicums unfolded.
- 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: compliance with methods, team meetings and informal meetings, teamwork, reception and transmission of information, acceptance of advice and comments, feedback, verification of the practicum supervisors' satisfaction.
- Adoption of attitudes and behaviours conducive to a successful practicum.
- Qualities appreciated by the employer and attitude allowing them to get the most out of the experience.
- Keeping a log: useful and meaningful items to incorporate into a report of the experience, importance of keeping the log up to date.
- Observations in the workplace: work context, tasks performed, application of work methods, etc.
- Introduction to new work techniques or processes, and recording of observations in the log.
- Performance of tasks in the workplace: active participation in the practicum.
- Occupational health and safety rules.
- Instructions and company rules.

Synthesis Phase

- Report on activities carried out during the practicum.
- Typical content of a practicum report: activities performed and observed on a daily basis, processes tried or new technologies used, new learning, problems encountered and solutions found, etc.
- Comments on the performance of tasks given by the practicum supervisors (use of log).
- Aspects to consider for self-evaluation: indication of positive elements observed and level of their satisfaction, indication of problems encountered and solutions found, view of the trade before and after the practicum (use of log).
- Comparison between the learning acquired at the vocational training centre and the activities observed and performed in the workplace.
- Aspects of the trade that are consistent or inconsistent with their training with respect to the workplace, trade practices, employment requirements, etc.

Glossary

The glossary below provides definitions of certain terms used in the following pages.

Butt welding positions

1G: flat position

2G: horizontal position

3G: vertical position

4G: overhead position

Fillet welding positions

1F: flat position

2F: horizontal position

3F: vertical position

4F: overhead position

Welding processes

FCAW	English:	Flux-cored arc welding[2]
	French:	*Soudage à l'arc avec fil tubulaire (fourré) sous protection gazeuse*
GMAW	English:	Gas metal arc welding
	French:	*Soudage à l'arc avec fil solide sous protection gazeuse*
GTAW	English:	Gas tungsten arc welding
	French:	*Soudage à l'arc avec électrode de tungstène (réfractaire) sous protection gazeuse*
SAW	English:	Submerged arc welding
	French:	*Soudage à l'arc submergé*
SMAW	English:	Shielded metal arc welding
	French:	*Soudage à l'arc avec électrode enrobée*

Cutting processes

CAC	English:	Air carbon arc cutting
	French:	*Coupage à l'arc avec électrode de carbone et jet d'air*
OFC	English:	Oxy-fuel cutting
	French:	*Oxycoupage*
PAC	English:	Plasma arc cutting
	French:	*Coupage à l'arc plasma*

[2] Arc welding always involves an electric arc.

Types of materials

Steel

Includes mild steel, alloy steel and low alloy steel, but **excludes** stainless steel, which is mentioned separately where applicable.

Metal

Includes all metals: steel, aluminum, stainless steel, cast iron, copper, etc. Specific metals are named where applicable.

Miscellaneous

Jigs and fixtures / Template: Made of objects such as components, guides and stops, these are used to position parts during assembly or welding, as well as for quality control.

HSS:
English: Hollow structural section
French: *Profilé creux*

Digital tools: Computer, tablet, smartphone, peripheral, software, app, etc.

Part: Metal component (e.g. plate, structural shape, pipe, hinge, slide, handle)

Éducation
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