

Vocational Training Program

5744

Precision Sheet Metal Work

Training Sector

11

Mechanical
Manufacturing

Reach for
your **Dreams**

Québec 



Vocational Training Program

5744

Precision Sheet Metal Work

Training Sector

11

Mechanical
Manufacturing

Formation professionnelle et technique
et formation continue

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INTRODUCTION

The *Precision Sheet Metal Work* program was designed on the basis of a framework for developing vocational training programs that calls for the participation of experts from the workplace and the field of education.

The program of study is developed in terms of competencies, expressed as objectives. These objectives are divided into modules. Various factors were kept in mind in developing the program: training needs, the job situation, purposes, goals, and strategies and means used to attain objectives.

The program of study lists the competencies that are the minimum requirements for a **Diploma of Vocational Studies (DVS)**, for students in both the youth and adult sectors. It also provides the basis for organizing courses, planning teaching strategies and designing instructional and evaluation materials.

The *Precision Sheet Metal Work* program leads to the Diploma of Vocational Studies. To be admitted to the program, students must meet one of the following conditions:

- For students holding a Secondary School Diploma or a recognized equivalent, no additional conditions are required.

OR

- For students who are at least 16 years of age on September 30 of the school year in which they begin the program, the following condition applies: they must have obtained Secondary IV credits in language of instruction, second language and mathematics, or the recognized equivalents.

OR

- For students who are at least 18 years of age, successful completion of the General Development Test and the mathematics 1007-2 course or its equivalent.

OR

- For students having obtained Secondary III credits in language of instruction, second language and mathematics in programs established by the Minister, general education is required in conjunction with vocational training in order to obtain the following credits, if applicable: Secondary IV language of instruction, second language and mathematics in programs established by the Minister.

The program of study is divided into 27 modules, which vary in length from 15 to 120 hours (multiples of 15). The common core is made up of 17 modules and there are five modules each for the fields of industrial and aerospace sheet metal work.

In industrial sheet metal work, 720 hours are spent on the specific competencies required to practise the trade, and 555 hours, on general competencies.

In aerospace sheet metal work, 690 hours are spent on the specific competencies required to practise the trade, and 585 hours, on general competencies.

In both cases, the time allocated to the program is to be used not only for teaching, but also for evaluation and remedial work.

The document contains two parts. Part I is of general interest and provides an overview of the program of study. It includes a synoptic table of the basic information about the modules, a description of the program training goals, the competencies to be developed and the general objectives, and an explanation of operational objectives. Part II is designed primarily for those directly involved in implementing the program. It contains a description of the operational objectives of each module. It also contains suggestions on the instructional approach and related content for each competency in the program. The suggestions are provided for information purposes only, while the operational objectives are compulsory.

GLOSSARY

Program Training Goals

Statements that describe the educational aims of a program. These goals are the general goals of vocational training adapted to a specific trade or occupation.

Competency

An organized body of knowledge and skills from a variety of fields, perceptions and attitudes that enable a person to correctly perform work-related tasks or activities.

General Objectives

Expression of educational aims or types of competencies to be developed. They serve as the basis for the grouping together of operational objectives.

Operational Objectives

Statements of the educational aims of a program in practical terms. They serve as the basis for teaching, learning and evaluation. In the competency-based approach, they represent competencies to be acquired in accordance with specific requirements.

Module of a Program

A component part of a program of study comprising a first-level operational objective and the related second-level operational objectives.

Credit

A unit used for expressing quantitatively the value of the modules in a program of study. One credit corresponds to 15 hours of training. Students must accumulate a set number of credits to graduate from a program.

Part I

1. SYNOPTIC TABLE

Number of modules: 27
 Duration in hours: 1 275
 Credits: 85

Precision Sheet Metal Work

Program code: 5744

CODE	MODULE NO.	TITLE OF THE MODULE (Common Core)	HOURS	CREDITS*
872 511	1	The Trade and the Training Process	15	1
872 523	2	Materials and Processes	45	3
872 534	3	Applied Mathematics	60	4
872 542	4	Sketches	30	2
872 555	5	Interpreting Drawings	75	5
872 563	6	Taking and Interpreting Measurements	45	3
872 572	7	Occupational Health and Safety	30	2
872 586	8	Making Bended Parts	90	6
872 592	9	Spot Welding	30	2
872 603	10	Making Roll-Bended and Embossed Parts	45	3
872 613	11	Manual Machining	45	3
872 624	12	Making Drawn and Punched Parts	60	4
872 636	13	Programming Cutting and Forming Machines	90	6
872 644	14	Operating a Numerical Control Punch	60	4
872 153	15	Adapting to New Types of Work Organization	45	3
872 656	16	Serial Production of Bended Parts	90	6
872 661	17	Using Job Search Techniques	15	1
Plus one of the following blocks:		<i>Industrial Sheet Metal Work</i>		
872 676	18	First Practicum	90	6
872 685	19	Operating a Laser Cutting Machine	75	5
872 692	20	Installing Fasteners	30	2
872 708	21	Making Assemblies	120	8
872 716	22	Second Practicum	90	6
		<i>Aerospace Sheet Metal Work</i>		
872 724	23	Installing and Removing Rivets and Other Fasteners	60	4
872 733	24	Adjusting the Shape of Parts	45	3
872 746	25	Making Subassemblies	90	6
872 758	26	Making Assemblies	120	8
872 776	27	Second Practicum	90	6

* 15 hours = 1 credit

This program leads to a Diploma of Vocational Studies in *Precision Sheet Metal Work*.

2. PROGRAM TRAINING GOALS

The training goals of the *Precision Sheet Metal Work* program are based on the general goals of vocational training and take into account the specific nature of the trade or occupation. These goals are:

To develop effectiveness in the practice of a trade.

- To teach students to perform precision sheet metal work tasks and activities correctly, at an acceptable level of competence for entry into the job market.
- To prepare students to progress satisfactorily on the job by fostering:
 - the intellectual skills required to interpret drawings and instructions and to plan and organize their work
 - the psychomotor skills required to correctly use cutting and forming machines
 - the skills required to program machine tools
 - attitudes and behaviours associated with quality control
 - work habits favouring health and safety

To ensure integration into the job market.

- To help students learn about their rights and responsibilities as workers.
- To help students learn about the job market in precision sheet metal work.
- To familiarize students with the new types of work organization.
- To familiarize students with the trade by allowing them to do a practicum in the workplace.

To foster personal development and the acquisition of trade-related knowledge.

- To foster independence, a sense of responsibility and a desire to succeed.
- To help students understand the principles underlying the different tasks involved in precision sheet metal work.
- To help students develop work methods.

To ensure job mobility.

- To help students acquire a solid basic education.
- To help students develop positive attitudes toward technological change and new situations.
- To help students learn how to learn.
- To help students prepare for a creative job search.

3. COMPETENCIES

The competencies to be developed in the *Precision Sheet Metal Work* program are shown in the grid of learning focuses on the following page. The grid lists general and specific competencies as well as the major steps in the work process.

General competencies involve activities common to several tasks or situations. They cover, for example, the technological or scientific principles that the students must understand to practise the trade or occupation. Specific competencies focus on tasks and activities that are of direct use in the trade or occupation. The work process includes the most important steps in carrying out the tasks and activities of the trade or occupation.

The grid of learning focuses shows the relationship between the general competencies on the horizontal axis and the specific competencies on the vertical axis. The symbol (Δ) indicates a correlation between a specific competency and a step in the work process. The symbol (O) indicates a correlation between a general and a specific competency. Shaded symbols indicate that these relationships have been taken into account in the formulation of objectives intended to develop specific competencies related to the trade or occupation.

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 of the grid shows the competencies directly related to the practice of a specific trade or occupation. These competencies are arranged in a relatively fixed order; therefore, the modules should be taught, insofar as possible, in the order represented on the grid. The modules including the general competencies on the horizontal axis should be taught in relation to those on the vertical axis. This means that some modules are prerequisite to others, while other modules are taught concurrently.

GRID OF LEARNING FOCUSES				WORK PRCESS (major steps)						GENERAL COMPETENCIES (related activities in technology, other subjects, personal development, etc.)														TOTALS	
		FIRST-LEVEL OPERATIONAL OBJECTIVES	DURATION (IN HOURS)	Prepare the work	Cut materials	Form parts	Assemble parts	Control quality	Maintain machines and tools	Determine their suitability for the trade and the training process	Interpret information about the characteristics of sheet metal and sheet metal work	Solve trade-related mathematical problems	Sketch parts	Interpret drawings	Verify the dimensions of parts	Follow occupational health and safety rules	Spot-weld parts	Perform manual machining operations	Program cutting and forming machines	Adapt to new types of work organization	Use job search techniques	Install fasteners (I)	Install and remove rivets and other fasteners (A)	NUMBER OF OBJECTIVES	DURATION (IN HOURS)
MODULES	MODULES									1	2	3	4	5	6	7	9	11	13	15	17	20	23	14	
	FIRST-LEVEL OPERATIONAL OBJECTIVES									S	B	B	B	B	B	B	B	B	B	B	B	B	B		
	DURATION (IN HOURS)									15	45	60	30	75	45	30	30	45	90	45	15	30	60		555: (I) 585: (A)
8	Make bended parts	B	90	▲	▲	▲		▲	△	○	●	●	●	●	●	●				○					
10	Make roll-bended and embossed parts	B	45	▲	▲	▲	▲	▲	△	○	●	●	○	●	●	●	●			○					
12	Make drawn and punched parts	B	60	▲		▲		▲	▲	○	●	○	○	●	●	●		●		○					
14	Operate a numerical control punch	B	60	▲	▲	▲		▲	▲	○	●	○		●	●	●		●	●	○					
16	Serially produce bended parts	B	90	▲		▲		▲	▲	○	●	○	○	●	●	●			●	●					
18	Begin practising the trade (I)	S	90	△	△	△	△	△	△	○	○	○	○	○	○	●	○	○	○	○	○	○			
19	Operate a laser cutting machine (I)	B	75	▲	▲			▲	▲	○	●	○		●	●	●			●	○					
21	Make an assembly (I)	B	120	▲	▲	▲	▲	▲	△	○	●	○	○	●	●	●	●	●	○	●		●			
22	Integrate into a workplace (I)	S	90	△	△	△	△	△	△	○	○	○	○	○	○	●	○	○	○	○	○	○			
24	Adjust the shape of parts (A)	B	45	▲		▲		▲		○	●	○		●	●	●				○					
25	Make a subassembly (A)	B	90	▲	▲	▲	▲	▲	△	○	●	○	○	●	●	●	●	●	○	●			●		
26	Make an assembly (A)	B	120	▲	▲	▲	▲	▲	△	○	●	○	○	●	●	●	●	●	○	●			●		
27	Integrate into a workplace (A)	S	90	△	△	△	△	△	△	○	○	○	○	○	○	●	○	○	○	○	○		○		
NUMBER OF OBJECTIVES		13																						27	
DURATION (IN HOURS)			720: (I) 690: (A)																						1275

B: Behavioural
S: Situational

(I): Industrial Sheet Metal Work
(A): Aerospace Sheet Metal Work

△ Correlation between a step and a specific competency
▲ Correlation to be taught and evaluated

○ Correlation between a general and a specific competency
● Correlation to be taught and evaluated

4. GENERAL OBJECTIVES

The general objectives of the *Precision Sheet Metal Work* program are presented below, along with the corresponding competencies.

To develop in the students the competencies required to integrate harmoniously into the school and work environments.

- Determine their suitability for the trade and the training process.
- Follow occupational health and safety rules.
- Adapt to new types of work organization.
- Use job search techniques.
- Begin practising the trade (industrial sheet metal work).
- Integrate into a workplace (industrial and aerospace sheet metal work).

To develop in the students the competencies required to perform basic trade-related tasks.

- Interpret information about the characteristics of sheet metal and sheet metal work.
- Solve trade-related mathematical problems.
- Sketch parts.
- Interpret drawings.
- Verify the dimensions of parts.
- Perform manual machining operations.
- Program cutting and forming machines.

To develop in the students the competencies required to cut and form parts.

- Make bended parts.
- Make roll-bended and embossed parts.
- Make drawn and punched parts.
- Operate a numerical control punch.
- Serially produce bended parts.
- Operate a laser cutting machine (industrial sheet metal work).
- Adjust the shape of parts (aerospace sheet metal work).

To develop in the students the competencies required to make assemblies.

- Spot-weld parts.
- Install fasteners (industrial sheet metal work).
- Make an assembly (industrial sheet metal work).
- Install and remove rivets and other fasteners (aerospace sheet metal work).
- Make a subassembly (aerospace sheet metal work).
- Make an assembly (aerospace sheet metal work).

5. OPERATIONAL OBJECTIVES

5.1 DEFINITION

An operational objective is defined for each competency to be developed. Competencies are organized into an integrated training program designed to prepare students to practise the trade or occupation. This systematic organization of competencies produces better overall results than training by isolated objectives. More specifically, it fosters a smooth progression from one objective to the next, saves teaching time by eliminating needless repetition, and integrates and reinforces learning material.

Operational objectives are the main, compulsory teaching/learning targets and they are specifically evaluated for certification. There are two kinds of operational objectives: behavioural and situational.

- A **behavioural objective** is a relatively closed objective that describes the actions and results expected of the student by the end of a learning step. Evaluation is based on expected results.
- A **situational objective** is a relatively open-ended objective that outlines the major phases of a learning situation. It allows for output and results to vary from one student to another. Evaluation is based on the student's participation in the activities of the learning context.

5.2 HOW TO READ OPERATIONAL OBJECTIVES

5.2.1 How to Read a Behavioural Objective

Behavioural objectives consist of five components, described in the first two columns. The first two provide an overview of the objective:

- The **expected behaviour** states a competency in terms of the general behaviour that the students are expected to have acquired by the end of the module.
- The **conditions for performance evaluation** define what is necessary or permissible to the students during evaluation designed to verify whether or not they have attained the objective. This means that the conditions for evaluation are the same wherever and whenever the program is taught.

The last three components ensure that the objective is understood clearly and unequivocally:

- The **specifications of the expected behaviour** describe the essential elements of the competency in terms of specific behaviours.
- The **performance criteria** define the requirements for each of the specifications of behaviour. They ensure a more enlightened decision on the attainment of the objective.
- The **field of application** defines the limits of the objective, where necessary. It indicates cases where the objective applies to more than one task, occupation or field.

The third column, **Suggested Approach/Related Content**, gives additional information about the learning activities, to be used at the instructor's discretion. It is important to note that establishments must continuously update this information in order to keep up with the changes in the job market.

5.2.2 How to Read a Situational Objective

Situational objectives consist of six compulsory components described in the first two columns:

- The **expected outcome** states a competency as an aim to be pursued throughout the course.
- The **specifications** outline the essential aspects of the competency and ensure a better understanding of the expected outcome.
- The **learning context** provides an outline of the learning situation designed to help the students develop the required competencies. It is normally divided into three phases of learning:
 - information
 - participation, practice or involvement
 - synthesis, integration and self-evaluation
- The **instructional guidelines** provide suggested ways and means of teaching the course to ensure that learning takes place and that the same conditions apply wherever and whenever the course is taught. These guidelines may include general principles or specific procedures.
- The **participation criteria** describe the requirements the students must fulfill. 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 context.
- The **field of application** defines the limits of the objective, where necessary. It indicates cases where the objective applies to more than one task, occupation or field.

The third column, **Suggested Approach/Related Content**, gives additional information about the learning activities, to be used at the instructor's discretion. It is important to note that establishments must continuously update this information in order to keep up with the evolution of the job market.

Part II

MODULE 1: THE TRADE AND THE TRAINING PROCESS			CODE: 872 511 15 hours
Expected Outcome	Instructional Guidelines	Suggested Approach	
<p>By participating in the required activities of the learning context according to the indicated criteria, the students will be able to determine their suitability for the trade and the training process.</p> <p>Specifications:</p> <p>Be familiar with the nature of the trade.</p> <p>Understand the program of study.</p> <p>Confirm their career choice.</p>	<ul style="list-style-type: none"> • Create in the classroom a climate that is conducive to the students' integration in the school. • Encourage the students to engage in discussions and to express themselves. • Motivate the students to take part in the suggested activities. • Help the students acquire an accurate perception of the trade. • Provide the students with the means of assessing their career choice honestly and objectively. • Organize field trips to companies that are representative of the main work environments in the trade. • Make available all pertinent documentation: information about the trade, programs of study, guides, etc. • Organize a meeting with specialists in the trade. 	<ul style="list-style-type: none"> • Distinguish between situational and behavioural objectives. • Prepare an observation checklist for the participation evaluation. 	

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 1 Information on the trade</p> <p>Learning about types of companies in which the trade is practised</p> <p>Learning about the nature and requirements of the trade</p> <p>Discussing their perception of the trade</p>	<ul style="list-style-type: none"> • Gather information about the types of companies in which the trade is practised, the nature of the tasks and the nature and requirements of the trade. • Share their perception of the trade at a group meeting, on the basis of the information gathered. 	<ul style="list-style-type: none"> • Characteristics of companies: types of companies, sectors of socioeconomic activity, types of production, manufacturing processes, etc. • Job situation: prospects, remuneration, advancement opportunities, etc. • Trade-related tasks: importance and complexity • Knowledge and skills needed to practise the trade • Rules governing group discussion: respect for others and for the objectives of the discussion

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 2 Information about the program and commitment to the training process</p> <p>Learning about the program of study and the training process</p> <p>Discussing the skills, aptitudes and knowledge required to practise the trade</p> <p>Discussing the relevance of the program of study with respect to the actual trade</p> <p>PHASE 3 Evaluation and confirmation of their career choice</p> <p>Stating their preferences and aptitudes with respect to the trade</p> <p>Evaluating their career choice by comparing the requirements of the trade with their preferences and aptitudes</p>	<ul style="list-style-type: none"> Seriously study the documents made available. Give their opinion about certain requirements of the trade. Adequately express their perception of the program of study at a group meeting. Produce a report containing: <ul style="list-style-type: none"> a brief description of their preferences and aptitudes reasons why they have decided to continue or abandon the training process 	<ul style="list-style-type: none"> Definitions: <ul style="list-style-type: none"> Aptitude: Innate capacity for learning or performing certain actions. Abilities, skills and competencies are based on aptitudes. Skill: Acquired ability to effectively use one's knowledge, movements, perceptions and so on to perform an action. Skills are an essential component of a competency. Competency: Integrated series of socioaffective behaviours and cognitive or psychosensorimotor skills that enable a person to adequately perform a duty, an activity or a task. Program of study: goals, general objectives and competencies to be acquired Content specific to <i>industrial</i> and <i>aerospace</i> sheet metal work Organization of courses and certification of modules Distinction between academic and vocational guidance Role of teachers and nonteaching professionals Parts of the report

MODULE 2: MATERIALS AND PROCESSES			CODE: 872 523 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must interpret information about the characteristics of sheet metal and sheet metal work in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- drawings of differently shaped parts- different types of materials- parts made using cutting, manual machining and forming operations• Using the appropriate documentation	<ul style="list-style-type: none">• Using samples, have the students identify different materials and help them develop the ability to recognize the direction of the grain.• Demonstrate shearing, drilling, folding and punching operations on different types and thicknesses of materials.• Have the students observe and comment on:<ul style="list-style-type: none">- the behaviour of different materials- adjustments to be made to the machines for different types and thicknesses of materials	

Specifications	Performance Criteria	Suggested Related Content
A. Recognize metallic materials.	<ul style="list-style-type: none"> • Recognition of the main types of metal by sight and by touch • Recognition of the direction of the grain • Accurate interpretation of material identification codes • Clear description of the main physical properties of materials 	<ul style="list-style-type: none"> • Ferrous and nonferrous metals: iron, cast iron, steel, steel alloys (stainless steel), aluminum, titanium, etc. • Sheet metal manufacturing processes and the direction of the grain • SAE, AISI and ASTM classifications; metal coding • Physical properties of metals: brittleness, ductility, elasticity, hardness, etc.
B. State the ability of certain materials to withstand cutting and machining operations.	<ul style="list-style-type: none"> • Clear description of the influence of the thickness of the material on cutting and machining operations • Clear description of the effects of cutting and machining operations on the material • Clear description of the relationship between the type of material, its thickness and the cutting and machining operations 	<ul style="list-style-type: none"> • Shearing: machines, features and applications • Sawing and drilling: machines and tools, features and applications • Effects of cutting and machining operations on materials: crushing, thinning, etc.
C. State the ability of certain materials to withstand bending operations.	<ul style="list-style-type: none"> • Clear description of the influence of the thickness of the material on bending operations • Clear description of the effects of bending operations on the material • Clear description of the relationship between the type of material, its thickness and the bending operations 	<ul style="list-style-type: none"> • Bending: methods, machines, tools, features and applications • Effects of bending operations on materials: cracking, peeling, thinning, tearing, etc.

Specifications	Performance Criteria	Suggested Related Content
D. State the ability of certain materials to withstand roll-bending and embossing operations.	<ul style="list-style-type: none">• Clear description of the influence of the thickness of the material on roll-bending and embossing operations• Clear description of the effects of roll-bending and embossing operations on the material• Clear description of the relationship between the type of material, its thickness and the roll-bending and embossing operations	<ul style="list-style-type: none">• Roll bending and embossing: machines, tools, features and applications• Effects of roll-bending and embossing operations on materials: stretching, upsetting, etc.
E. State the ability of certain materials to withstand punching and drawing operations.	<ul style="list-style-type: none">• Clear description of the influence of the thickness of the material on punching and drawing operations• Clear description of the effects of punching and drawing operations on the material• Clear description of the relationship between the type of material, its thickness and the punching and drawing operations	<ul style="list-style-type: none">• Punching and drawing: machines, tools, features and applications• Effects of punching and drawing on materials: tearing, scoring, distortion, etc.

MODULE 3: APPLIED MATHEMATICS		CODE: 872 534 60 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
<p>To demonstrate the required competency, the students must solve trade-related mathematical problems in accordance with the following conditions, criteria and specifications.</p>	<ul style="list-style-type: none"> • Working alone • Given diagrams of parts with dimensions indicated in metric and imperial units • Using: <ul style="list-style-type: none"> - conversion tables - mathematical formulas - a calculator 	<ul style="list-style-type: none"> • Determine the students' need for additional mathematical knowledge before addressing this competency. • Do demonstrations and have the students do exercises so that they can visualize dimensions in metric and imperial units. • Have the students solve problems such as: <ul style="list-style-type: none"> - How long and wide must a sheet be in order to make a specific roll-bended part? - Calculate the angles of bended parts using the Pythagorean theorem and trigonometric functions. - Determine the number of parts that can be made from one sheet of metal. • Have them answer with different degrees of precision. • Help them develop the habit of verifying the plausibility of their calculations.

Specifications	Performance Criteria	Suggested Related Content
A. Determine the necessary conversions or calculations.	<ul style="list-style-type: none"> • Recognition of the system of measurement used • Appropriate choice of conversion methods or mathematical formulas 	<ul style="list-style-type: none"> • Imperial units and their representation: ft., in., 1/8", 1/4", 0.125", 0.250", etc. • Metric units and their representation: m, cm, mm, 2.5 cm, 25 mm, etc. • Conversion from metric to imperial units and vice versa • Multiplying and dividing by a constant
B. Convert units of measurement.	<ul style="list-style-type: none"> • Proper use of conversion tables • Accurate calculations • Results presented according to the required degree of precision 	<ul style="list-style-type: none"> • Reading and interpreting tables of metric and imperial units • Main functions of a calculator • Interpretation of number of figures after the decimal point
C. Calculate the dimensions of the part.	<ul style="list-style-type: none"> • Correct application of rules for transforming mathematical formulas • Correct use of mathematical formulas • Accurate calculations • Results presented according to the required degree of precision 	<ul style="list-style-type: none"> • Calculating circumferences, radius, arcs, angles, perimeters and surfaces of differently shaped parts • Calculating angles and lengths using trigonometric functions: sine, cosine and tangent • Calculations using the Pythagorean theorem • Calculating the bend radius • Calculations using bend allowance tables • Calculating inside and outside diameter and the neutral axis
D. Verify their results.	<ul style="list-style-type: none"> • Appropriate choice and use of proof method • Evaluation of plausibility of results 	<ul style="list-style-type: none"> • Methods of rearranging formulas: cross product, rule of three, isolating a variable, etc.

MODULE 4: SKETCHES		CODE: 872 542 30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must sketch parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Working freehand• Given:<ul style="list-style-type: none">- a part- a sketch in three dimensions- a sketch containing the three views of a part• Using:<ul style="list-style-type: none">- graph or isometric paper- a ruler and a compass	<ul style="list-style-type: none">• Explain the need to draw sketches in order to visualize a part and to convey information to colleagues.• Help students develop a sense of spatial perception by showing them objects and their associated views.• At first, use graph or isometric paper.• Use the box method.• Dimension the sketches in both systems of measurement.

Specifications	Performance Criteria	Suggested Related Content
A. Draw the orthogonal views of a part.	<ul style="list-style-type: none"> • Inclusion of all lines • Clarity of lines • Observance of proportions • Proper arrangement of views • Accurate representation of the top, front and side views of the part 	<ul style="list-style-type: none"> • The three main views, their relative positions, and first- and third-angle projections • The six views, single- and double-view drawings • Technique for drawing lines: methods of drawing vertical and horizontal lines, circles and arcs • Visible and hidden contours, solid and interrupted lines • Relative proportion and reproduction of dimensions: 45° line, scale, dividers, sketch of a rectangle
B. Draw a three-dimensional view of a part.	<ul style="list-style-type: none"> • Proper application of projection rules • Inclusion of all lines • Clarity of lines • Observance of proportions • Drawing in conformity with part 	<ul style="list-style-type: none"> • Isometric sketches and the steps involved: outline of box and details • Sketch of two views on isometric paper • Oblique sketch on graph paper
C. Draw opposite views of a part.	<ul style="list-style-type: none"> • Inclusion of all lines • Clarity of lines • Observance of proportions • Drawing in conformity with view 	<ul style="list-style-type: none"> • Identification of left and right parts • Plane of symmetry for the left and right parts • Relative position of the three views for the left and right parts

Specifications	Performance Criteria	Suggested Related Content
D. Dimension the sketches.	<ul style="list-style-type: none">• Proper choice of dimensions to be indicated• Proper choice of values• Observance of rules governing dimensioning• Clarity of dimension lines• Legibility	<ul style="list-style-type: none">• Dimensions to be indicated and superfluous dimensions (clarity of sketch)• Dimensioning of views• Dimensioning of part: size and location• Dimensioning of rectangular prisms, cylinders, etc.• Dimensioning of holes, angles, radii and diameters• Positioning of size and location dimensions• Dimensioning standards: weight of lines, spacing between dimensions, arrows, numbers, etc.

MODULE 5: INTERPRETING DRAWINGS		CODE: 872 555 75 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must interpret drawings in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given detail and assembly drawings in metric and imperial units of measurement, including first- and third-angle projections• Using:<ul style="list-style-type: none">- the appropriate technical documentation- mathematical formulas- a calculator	<ul style="list-style-type: none">• Explain to the students that being able to interpret drawings is essential to practising the trade.• Help them develop the competency using drawings of parts to be produced in the development of later competencies.• Use assemblies and their drawings to teach students to identify components.• When describing the part and assembly, have the students sketch three-dimensional and other views.

Specifications	Performance Criteria	Suggested Related Content
A. Look at the drawing and the supplementary information.	<ul style="list-style-type: none"> • Accurate distinction between the types of views used • Identification of sections • Clear distinction of the relationships between views and sections • Identification of relevant information in the title block, notes and updates • Accurate interpretation of codes, symbols and abbreviations 	<ul style="list-style-type: none"> • Top, front and side views and their relative positions • First- and third-angle projections • Orthogonal, isometric and oblique projections • General and local notes • Full, broken-out, revolved and removed sections • Lines, visible and hidden edges, contour lines, etc. • Hatching and its meaning
B. Interpret the dimensions.	<ul style="list-style-type: none"> • Identification of reference surfaces • Identification of dimensions, annotations and tolerances • Accurate interpretation of codes, symbols and abbreviations • Determination of the size of the part on the basis of dimensions and tolerances 	<ul style="list-style-type: none"> • Dimensioning based on reference surfaces in order to avoid an accumulation of tolerances • Size dimensions of various geometric shapes • Form and position tolerances and their symbols • Dimensions with tolerances • Functional dimensioning
C. Calculate the values not indicated on the drawing.	<ul style="list-style-type: none"> • Appropriate choice of lengths and angles to be calculated • Appropriate choice of mathematical formulas • Correct use of mathematical formulas • Accurate calculations 	<ul style="list-style-type: none"> • Calculations using basic mathematical operations, trigonometric functions and the Pythagorean theorem

Specifications	Performance Criteria	Suggested Related Content
D. Describe the parts and the assembly.	<ul style="list-style-type: none">• Clear description of the shape of the parts• Clear description of the relative position of the parts• Clear description of the shape of the assembly	

MODULE 6: TAKING AND INTERPRETING MEASUREMENTS		CODE: 872 563 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must verify the dimensions of parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given cut, bended, punched, drawn and roll-bended parts and their respective drawings• Using:<ul style="list-style-type: none">- analogue and digital measuring instruments and checking templates- a steel or granite table- a calculator	<ul style="list-style-type: none">• Explain to the students the importance of this competency for quality control.• Use parts and drawings introduced in Module 5.• Ensure that the students develop the competency in both systems of measurement and using both analogue and digital instruments.• Help the students develop autonomy in the choice of measuring instruments and the determination of conformity.

Specifications	Performance Criteria	Suggested Related Content
A. Prepare to take measurements. B. Verify the calibration of measuring instruments.	<ul style="list-style-type: none">• Identification of information about the dimensions and tolerances to be measured• Accurate determination of type of measurement• Choice of instruments in accordance with the measurements to be taken• Proper application of verification method• Determination of precision of instrument with respect to tolerances	<ul style="list-style-type: none">• Instruments: steel rule, tape measure, compass, inside and outside micrometers, protractor, universal square, vernier calliper, marking (telescopic) gauge, etc.• Measurements of length, thickness, radius, depth, etc.• Gauge for verifying vernier callipers• Types and causes of vernier calliper wear• Micrometer adjustments• Use of calibration gauges• Degree of precision of instruments and interpretation of measurements

Specifications	Performance Criteria	Suggested Related Content
C. Measure lengths, thicknesses, angles and radii of parts.	<ul style="list-style-type: none"> • Appropriate choice and application of measuring methods • Proper positioning of instruments and parts • Appropriate choice of reference points and surfaces • Proper use of measuring instruments • Correct interpretation of readings • Accurate measurements 	<ul style="list-style-type: none"> • Digital and analogue readings • Importance of selecting the proper graduation • Direct and indirect measuring methods • Reference points and surfaces in terms of incremental or absolute dimensioning • Cast iron and granite surface plates • Inside and outside measurements using a compass • Measuring depth and angles with a combination square • Technique for using Pi Tapes • Inside and outside measurements and measuring depth using a vernier calliper • Using a micrometer • Using a marking gauge with a clamping angle and bars
D. Determine the acceptability of the part.	<ul style="list-style-type: none"> • Comparison of measurements with values in the drawing • Accurate interpretation of dimensional tolerances • Accurate interpretation of geometric tolerances • Accurate interpretation of positional tolerances • Correct decision 	<ul style="list-style-type: none"> • Calculations associated with measurement (minimum and maximum values, tolerances, etc.) • Criteria affecting the decision

MODULE 7: OCCUPATIONAL HEALTH AND SAFETY			CODE: 872 572 30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must follow occupational health and safety rules in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- examples of unsafe behaviours and attitudes in the performance of trade-related tasks- examples of incidents or accidents occurring in the performance of trade-related tasks• Using the appropriate documentation	<ul style="list-style-type: none">• Invite resource people to describe and analyze actual situations in order to help the students develop a desire to adopt preventive behaviour at work.• When using machines and tools, demonstrate safe behaviour, clearly explaining the risks inherent in their use.	

Specifications	Performance Criteria	Suggested Related Content
A. Recognize trade-related risks and their effects on occupational health and safety.	<ul style="list-style-type: none">• Clear description of the risks associated with the handling of materials and their effects on occupational health and safety• Clear description of the risks associated with the use of cutting and forming machines and their effects on occupational health and safety• Clear description of the risks associated with the use of machining tools and their effects on occupational health and safety• Clear description of the risks associated with the use of assembly machines and tools and their effects on occupational health and safety	<ul style="list-style-type: none">• Feelings of malaise caused by inappropriate environmental conditions• Contusions and fractures caused by clutter in the work area• Contusions and cuts caused by falling objects and the handling of materials• Foot injuries caused by falling objects• Musculoskeletal injuries, repetitive stress injuries and back pain• Cuts, contusions and fractures caused by moving machine parts• Eye injuries caused by the projection of particles• Impaired hearing caused by exposure to noise• Risk of burns and electrocution when adjusting and using spot-welding or laser cutting machines• Risk of electrocution when using portable electric tools

Specifications	Performance Criteria	Suggested Related Content
B. Prevent accidents.	<ul style="list-style-type: none"> • Recognition of the rights and obligations of the parties involved • Use of the appropriate personal safety equipment • Safe handling of materials • Recognition of safety devices on machine tools 	<ul style="list-style-type: none"> • Rights and obligations of employers and workers • Regulation respecting industrial and commercial establishments (REIC) • Regulation respecting information on controlled products (RIPC) • Regulation respecting the quality of the work environment (RQMT) • Workplace hazardous materials information system (WHMIS) • Use of safety gloves and shoes and fitted clothing • Use of safety glasses and hearing protectors • Safety devices on band mills, squaring shears, press brakes, drawing presses, punching machines, laser cutting machines and setting presses • Organization of work station and uncluttered work areas
C. Apply the appropriate measures following a work accident.	<ul style="list-style-type: none"> • Recognition of the seriousness of the situation • Correct decision to provide assistance or to call for outside help 	<ul style="list-style-type: none"> • Main characteristics of emergency procedures • Resource people in companies • Responsibilities of the parties

MODULE 8: MAKING BENDED PARTS		CODE: 872 586 90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
<p>To demonstrate the required competency, the students must make bended parts in accordance with the following conditions, criteria and specifications.</p>	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel and aluminum • Using: <ul style="list-style-type: none"> - a squaring shear - a press brake with two or more axes - punches and dies - a bend chart - mathematical formulas - measuring instruments and checking templates - identification materials 	<ul style="list-style-type: none"> • Gradually increase the complexity of the bending. • Bend pieces of mild steel 0.025" to 0.125" thick, stainless steel 0.025" to 0.040" thick and type-H and type-T aluminum 0.025" to 0.125" thick. • Have the students sketch the steps in the bending process and state the effects of the chosen bending sequence on its feasibility. • The students should refer frequently to bend allowance tables to calculate the dimensions of the parts needed. • Use different types and thicknesses of materials with different characteristics (stress, hardness, springback). • Have the students learn to use a squaring shear in conjunction with Module 10. • Use a simple parts identification technique.

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Calculate the dimensions of the parts.</p> <p>C. Adjust the shear.</p>	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Appropriate choice of material • Appropriate use of bend chart or mathematical formulas • Accurate calculations • Blade-gap adjustment in accordance with type and thickness of material • Accurate adjustment of back gauge • Adjustment of stroke in accordance with length of material • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See Modules 2 and 5. • See Module 3. • Components of mechanical and hydraulic shearing machines and their respective functions • Capacity of a shearing machine • Manual and electrical control devices for: <ul style="list-style-type: none"> - adjusting the blade gap - positioning the back gauge - adjusting the stroke • Adjustment of stroke in accordance with the length of the material and cutting time • Idle stroke • Safe adjustment of shearing machine in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
D. Cut the material.	<ul style="list-style-type: none">Careful handling of materialVerification of squaring of materialProper positioning of materialProper use of squaring shearParts in conformity with specificationsObservance of occupational health and safety rules	<ul style="list-style-type: none">Squaring, supporting the material on the side guide, and making a narrow cutPositioning the material, supporting it on the back gaugesUniform wear of blades as a result of cutting at different pointsVerification of dimensions of part (see Module 6)Safe use of shearing machine in terms of the risks and safety measures addressed in Module 7
E. Determine the steps in the bending process.	<ul style="list-style-type: none">Determination of the steps in the bending process in accordance with the number of bends, the dimensions of the part and tolerancesProper use of sketches to represent the steps in the bending process	<ul style="list-style-type: none">Height of bends and workspace between the punches and diesBends to be used as references to avoid the accumulation of tolerances

Specifications	Performance Criteria	Suggested Related Content
F. Install the punch and die and adjust the press brake.	<ul style="list-style-type: none">• Choice of punch and die in accordance with bend radius and type and thickness of material• Accurate alignment of punch and die• Solid installation of punch and die• Accurate adjustment of back gauge• Accurate adjustment of tonnage• Accurate adjustment of vertical stroke• Idle test• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Types of press brakes and their features• Parts of press brakes and their respective functions• Identification of axes• Capacity of a press brake• Shapes, radius and angles of punches and dies• Interpretation of bend chart: bend force in accordance with v die opening and thickness of material• Uniform wear of machine as a result of the positioning of the punch and die• Punch and die holder• Manual and electrical control devices for:<ul style="list-style-type: none">- positioning gauges- adjusting the stroke- adjusting the tonnage• Alignment of punches and dies:<ul style="list-style-type: none">- visual verification of X and Z alignment and clamping- insertion of punch in die with idle stroke and clamp• Safe adjustment of press brake in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
G. Bend the parts.	<ul style="list-style-type: none"> Careful handling of material Proper positioning of parts Proper application of bending method Proper use of press brake Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Bending methods: air bending and bottoming Press brake routines Safe use of press brake in terms of the risks and safety measures addressed in Module 7
H. Control the quality of bended parts.	<ul style="list-style-type: none"> Appropriate choice and use of measuring instruments and checking templates Accurate interpretation of measurements Accurate interpretation of drawing or work order Full inspection of integrity of material Correct decision concerning the conformity of the part with specifications 	<ul style="list-style-type: none"> Checking templates for verifying bended parts Interpretation of drawings and verification of the dimensions of a bended part (see Modules 5 and 6) Possible manufacturing defects in bended parts: curve radius, delamination, scratching, etc.
I. Finish the work.	<ul style="list-style-type: none"> Proper application of identification method Cleanliness of work area 	<ul style="list-style-type: none"> Identification of parts using: <ul style="list-style-type: none"> ink electrolytic etching a Vibro pen a laser a punch a riveted identification plate etc.

MODULE 9: SPOT WELDING		CODE: 872 592 30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must spot-weld parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- work orders or drawings- parts made of mild steel, stainless steel and aluminum• Using:<ul style="list-style-type: none">- a spot-welding machine- welding jigs and clamps- a welding process sheet- cleaning products	<ul style="list-style-type: none">• Explain the spot-welding process and compare it with other processes.• At first, tack-weld 4" squares of mild steel, stainless steel and aluminum 0.025" to 0.125" thick.• Give the students a variety of shapes to tack-weld, and help them determine a welding sequence and develop the spot-welding skills needed to make assemblies.

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none">• Accurate interpretation of symbols, codes and abbreviations• Determination of tack-welding sequence in accordance with the drawing and the welding processes in question	<ul style="list-style-type: none">• Weldability of mild steel, stainless steel and aluminum• Principle, applications and limitations of spot welding• Welding symbols used in spot welding• Factors that influence the choice of a welding process• Brief description of the SMAW, TIG and MIG processes• Principles and symbols associated with the SMAW, TIG and MIG processes
B. Prepare the parts.	<ul style="list-style-type: none">• Careful handling of parts• Appropriate inspection of part surfaces• Proper choice and application of preparation method• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Surface defects: oxidation, contamination, paint, oil, grease or other electrical insulators• Types of cleaning products and their uses• Preparation methods using abrasives: sanding and grinding• Use of safety devices and personal safety equipment when sanding and grinding

Specifications	Performance Criteria	Suggested Related Content
C. Install the electrodes.	<ul style="list-style-type: none"> • Appropriate choice of electrodes • Proper verification and sharpening of electrodes • Proper alignment of electrodes • Solid installation of electrodes and holders • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Parts of an electrode: body, hole for water circulation, tip • Electrode materials: copper, copper and chrome, zirconium copper, zirconium chrome • Electrode shapes and their uses: radius tip, flat tip, etc. • Electrode wear and sharpening techniques • Alignment of electrodes on articulated-arm and rectilinear welding machines • Safe installation of electrodes in terms of the risks and safety measures addressed in Module 7
D. Adjust the spot-welding machine.	<ul style="list-style-type: none"> • Accurate interpretation of welding process sheet • Proper adjustment of amperage, pressure on the electrodes and welding sequence • Proper shear and separation tests • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Welding sequence: squeezing, welding, cooling, rate • Effects of adjustment of quality of welding point • Verification of welding point by grinding after shearing • Safe adjustment of welding machine in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
E. Spot-weld.	<ul style="list-style-type: none">• Careful handling of parts• Proper positioning of parts• Proper application of tack-welding sequence• Welding points at the appropriate locations• Alignment of welding points• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Clamps• Dimensions of overlap for superimposed parts• Safe use of welding machine in terms of the risks and safety measures addressed in Module 7

MODULE 10: MAKING ROLL-BENDED AND EMBOSSED PARTS			CODE: 872 603 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must make roll-bended and embossed parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none"> Working alone Given: <ul style="list-style-type: none"> work orders or drawings sheets of mild steel, stainless steel or aluminum Using: <ul style="list-style-type: none"> a squaring shear a pyramid roller forming rollers a spot-welding machine clamps identification materials 	<ul style="list-style-type: none"> Make roll-bended parts such as cylinders and cones, gradually increasing the level of difficulty. Make the first cylinders using a manual roller: <ul style="list-style-type: none"> mild steel: 6" diameter, 0.025" thick stainless steel: 5" to 12" diameter, 0.025" thick Using an electric roller, make parts out of mild steel or aluminum: 8" to 10" diameter, up to 0.064" thick. Do different types of embossing on the inside and outside of previously rolled thin sheets. Have the students learn to use a squaring shear in conjunction with Module 8. Use a different identification technique from the one used in Module 8. 	

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Calculate the dimensions of the parts.</p> <p>C. Adjust the shearing machine.</p>	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Choice of material • Appropriate choice and use of mathematical formulas • Accurate calculations • Blade-gap adjustment in accordance with type and thickness of material • Accurate adjustment of back gauge • Adjustment of stroke in accordance with length of material • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See Modules 2 and 5. • See Module 3. • Components of mechanical and hydraulic shearing machines and their respective functions • Capacity of a shearing machine • Manual and electrical control devices for: <ul style="list-style-type: none"> - adjusting the blade gap - positioning the back gauge - adjusting the stroke • Adjustment of stroke in accordance with the length of the material and cutting time • Idle stroke • Safe adjustment of shearing machine in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
D. Cut the material.	<ul style="list-style-type: none"> Careful handling of material Verification of squaring of material Proper positioning of material Proper use of squaring shear Parts in conformity with specifications Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Squaring, supporting the material on the side guide, and making a narrow cut Positioning the material, supporting it on the back gauges Uniform wear of blades as a result of cutting at different points Verification of dimensions of part (see Module 6) Safe use of shearing machine in terms of the risks and safety measures addressed in Module 7
E. Adjust the rollers and roll-bend the parts.	<ul style="list-style-type: none"> Adjustment of lead roller in accordance with thickness of material and diameter of part to be produced Parallel rollers Careful handling of material Proper application of roll-bending method Proper use of roll-bending machine Conformity of parts with specifications Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Components of roll-bending machines and their functions: pyramid roller and adjustment devices Use of thickness samples to verify that the rollers are parallel Method of rolling the ends of the part and gradually reducing the distance between the rollers Use of templates, tape measure and Pi Tape to verify conformity with specifications Safe use of roll-bending machine in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
F. Spot-weld the ends of the parts.	<ul style="list-style-type: none"> • Proper installation of clips • Appropriate adjustment and use of spot-welding machine • Solidity of tack welding 	<ul style="list-style-type: none"> • See Module 9.
G. Adjust the forming rollers and emboss the parts.	<ul style="list-style-type: none"> • Appropriate choice of forming rollers • Accurate alignment of forming rollers • Accurate alignment of stops • Careful handling of material • Proper application of embossing method • Proper use of forming rollers • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Types of embossing and types of rollers • Alignment method: insertion, adjusting screw, etc. • Accurate and steady position maintained by resting the part squarely on the guide
H. Control the quality of roll-bended and embossed parts.	<ul style="list-style-type: none"> • Appropriate choice and use of measuring instruments and checking templates • Accurate interpretation of measurements • Accurate interpretation of drawing or work order • Full inspection of integrity of material • Correct decision concerning the conformity of the part with specifications 	<ul style="list-style-type: none"> • Interpretation of drawings and verification of the dimensions of a roll-bended and embossed part (see Modules 5 and 6) • Possible manufacturing defects of roll-bended and embossed parts: production of a flat bar, curve radius, etc.
I. Finish the work.	<ul style="list-style-type: none"> • Proper application of identification method • Cleanliness of work area 	<ul style="list-style-type: none"> • Identification of parts (see Module 8)

MODULE 11: MANUAL MACHINING		CODE: 872 613 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
<p>To demonstrate the required competency, the students must perform manual machining operations in accordance with the following conditions, criteria and specifications.</p>	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel and aluminum - mild steel and aluminum sections • Using: <ul style="list-style-type: none"> - saws, shearing machines, notching presses, hand-lever punching machines, drills, trimmers and grinders - measuring, verifying and marking-out instruments - drill bits, cutters and taps - cutting oils and lubricants 	<ul style="list-style-type: none"> • Explain how manual machining relates to the trade. • Explain the difference between the manual machining of sheet metal and sections and the work done by machinists. • Have the students do specific exercises to develop basic skills in cutting, drilling, chamfering and tapping for all of the specifications. • If circumstances permit, produce the drill jigs needed for Module 23 (<i>aerospace</i> option).

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none">• Accurate interpretation of codes, symbols and abbreviations• Appropriate choice of material• Determination of the actual size on the basis of the dimensions and tolerances	<ul style="list-style-type: none">• Symbols, codes, abbreviations and notes related to drilling, boring, chamfering and tapping• Nominal, maximum and minimum dimensions
B. Mark out sheets and sections.	<ul style="list-style-type: none">• Appropriate choice of measuring methods• Appropriate choice of reference points and surfaces• Appropriate choice of measuring instruments• Proper application of marking-out techniques	<ul style="list-style-type: none">• Choice and use of measuring instruments (see Module 6)• Marking-out instruments: layout tables, scribes, centre punches, etc.• Using a ruler and scribe, compass, marking gauge and square, etc.

Specifications	Performance Criteria	Suggested Related Content
C. Cut out sheets and sections.	<ul style="list-style-type: none">• Proper positioning of material• Proper use of cutting oils or lubricants• Appropriate use of tools• Parts in conformity with specifications• Quality of deburring• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Features and operation of hand saws and band saws• Choice of cutting speed in accordance with type and thickness of material• Features and operation of rocking shears and combination machines• Features and operation of hand-lever punching machines• Features and operation of manual notching presses and trimmers• Use of measuring instruments (see Module 6)• Deburring methods using files, air tools, belt sanders, etc.• Use of safety devices and personal safety equipment when shearing, notching, trimming and deburring

Specifications	Performance Criteria	Suggested Related Content
D. Drill parts.	<ul style="list-style-type: none">• Appropriate choice of bits• Proper inspection and sharpening of bits• Proper positioning of part to be drilled• Appropriate choice of speed• Proper use of cutting oils or lubricants• Appropriate use of tools• Appropriate boring• Holes perpendicular and circular• Quality of deburring• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Carbon steel, high-speed steel and carbide tip bits, etc.• Sizes of bits and their identification• Verification of dimensions using a drill gauge and a micrometer• Sharpening bits: length and angle of cutting lips, clearance angle, etc.• Formulas and tables for selecting cutting and rotation speeds• Use of hand drills and sensitive drill presses and drilling techniques• Types of reamers: three-flute, four-flute, hand reamers, etc.• Cutting and feed rates in accordance with the type and thickness of the material and the boring tool• Cutting oils• Use of measuring instruments (see Module 6)• Deburring methods using files, air tools, etc.• Use of safety devices and personal safety equipment when drilling, boring and deburring

Specifications	Performance Criteria	Suggested Related Content
E. Chamfer parts.	<ul style="list-style-type: none">• Appropriate choice of cutters• Proper positioning of part• Appropriate choice of speed• Proper use of cutting oils or lubricants• Appropriate use of tools• Chamfer perpendicular and at the appropriate depth• Quality of deburring• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Types of cutters and their characteristics• Choice of speed in accordance with the material and tool• Chamfering techniques• Cutting oils• Use of measuring instruments (see Module 6)• Use of safety devices and personal safety equipment when chamfering
F. Tap parts.	<ul style="list-style-type: none">• Appropriate choice of taps• Proper positioning of part• Proper use of cutting oils or lubricants• Proper application of tapping method• Threads in conformity with specifications• Quality of deburring	<ul style="list-style-type: none">• Taper, plug and bottoming taps• Sizes of taps and their identification• Tapping techniques: drilling, verification of squareness, etc.• Technique for extracting a broken tap

MODULE 12: MAKING DRAWN AND PUNCHED PARTS			CODE: 872 624 60 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must make drawn and punched parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel or aluminum • Using: <ul style="list-style-type: none"> - a mechanical or hydraulic press - punches and dies - measuring instruments and checking templates - identification materials - a checklist and maintenance program - the operating manual - cleaning products, greases and lubricants - the appropriate tools 	<ul style="list-style-type: none"> • Begin by having the students make drawn parts by hand (e.g. produce an inner or outer dome out of a conical piece of mild or stainless steel 0.025" thick). • Make punched parts out of drawn parts. • Use a different identification technique from those used in earlier modules. • Emphasize occupational health and safety. • Use the machine's checklist and maintenance program to help the students acquire knowledge and skills related to the responsibilities and maintenance activities of sheet metal workers. 	

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Install the punch and die and adjust the press.</p>	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Appropriate choice of material • Choice of punch and die in accordance with the thickness and shape of the part to be produced • Full inspection of integrity of punch and die • Solid installation of punch and die • Accurate and safe adjustment of tonnage or stroke • Idle stroke • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See Modules 2 and 5. • Types of mechanical and hydraulic presses and their features • Components of mechanical and hydraulic presses and their respective functions • Capacity of mechanical and hydraulic presses • Shapes of punches and dies and their applications • Components of punching and drawing punches and dies: holder, body, perforation, etc. • Play between punch and die in accordance with the type and thickness of the material • Control devices for adjusting stroke and tonnage • Cracks and wear of punches and dies • Safe installation of punches and dies in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
C. Draw or punch the parts.	<ul style="list-style-type: none"> Careful handling of material Proper use of lubricants Proper positioning of parts Proper application of drawing or punching method Proper use of mechanical or hydraulic press Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Forms and methods of drawing and punching Mechanical and hydraulic press routines Protective coatings for materials Types of lubricants and their respective functions Safe use of mechanical or hydraulic press in terms of the risks and safety measures addressed in Module 7
D. Control the quality of drawn or punched parts.	<ul style="list-style-type: none"> Appropriate choice and use of measuring instruments and checking templates Accurate interpretation of measurements Accurate interpretation of drawing or work order Full inspection of integrity of material Correct decision concerning the conformity of the part with specifications 	<ul style="list-style-type: none"> Checking templates for drawn and punched parts Interpretation of drawings and verification of the dimensions of a drawn or punched part (see Modules 5 and 6) Possible manufacturing defects in drawn and punched parts: cracking, scratching, peeling, etc.
E. Finish the parts.	<ul style="list-style-type: none"> Removal of excess material Quality of deburring Proper application of identification method 	<ul style="list-style-type: none"> See Module 11. Identification of parts (see Module 8)
F. Maintain the press and tools.	<ul style="list-style-type: none"> Appropriate use of checklist and maintenance program Appropriate cleaning of punches and dies Proper application of maintenance procedure for the press 	

MODULE 13: PROGRAMMING CUTTING AND FORMING MACHINES			CODE: 872 636 90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must program cutting and forming machines in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone to program and to simulate machine tool operations on a computer• Given work orders or drawings• Using:<ul style="list-style-type: none">- the list of the machine's programming codes- a microcomputer- software for the manual programming of a punching or laser cutting machine- programming software for the press brake	<ul style="list-style-type: none">• Explain the difference between manual and automatic programming.• Introduce the students to software by having them program cutting and forming machines for simple parts requiring the use of the software's major functions.• Help the students develop autonomy in using the software.	

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the program.</p> <p>B. Manually program a punching or laser cutting machine.</p>	<ul style="list-style-type: none"> • Accurate interpretation of symbols, codes and abbreviations • Determination of appropriate sequence of operations • Accurate calculation of missing rectangular or polar coordinates • Appropriate choice of programming codes • Program sequence in conformity with choice • Proper application of procedure for entering codes and data • Proper application of validation procedure • Conformity of parameters with parts to be made • Proper saving of file 	<ul style="list-style-type: none"> • Symbols, codes and abbreviations associated with bending, punching and cutting • Position of tools and collets • Dimensions of the table and limits of travel • Shapes of punches and dies and their applications • The main codes and their function: <ul style="list-style-type: none"> - pattern line - pattern arc - pattern circle - pattern grid - etc. • Opening and closing codes • Consultation and use of tool library • Abscissa and ordinate calculations and trigonometric calculations of angles • Mirror functions • Macro functions and subroutines • Order in which data and codes are entered, and syntax • Location and correction of software errors • Saving of files on diskette and on the server

Specifications	Performance Criteria	Suggested Related Content
C. Program a press brake.	<ul style="list-style-type: none">• Program sequence in conformity with choice• Proper application of procedure for entering codes and data• Proper application of validation procedure• Conformity of parameters with parts to be made• Proper saving of file	<ul style="list-style-type: none">• Program start-up procedure• The main functions of the software:<ul style="list-style-type: none">- creating a new part- selecting a program- editing an existing part- access to library of punches and dies- communication protocol- etc.• Data entry: lengths and angles• Consultation and use of library of tools• Location and correction of software errors• Saving of file on diskette and on the server

MODULE 14: OPERATING A NUMERICAL CONTROL PUNCH			CODE: 872 644 60 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must operate a numerical control punch in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel or aluminum - a storage medium or link • Using: <ul style="list-style-type: none"> - a numerical control punch - punches and dies - measuring instruments - identification materials - a checklist and maintenance program - the operating manual - cleaning products, greases and lubricants - the appropriate tools 	<ul style="list-style-type: none"> • Coordinate this module with the module on programming cutting and forming machines by running certain programs developed in the earlier module. • Perform a variety of operations (e.g. punching, drawing, cutting, stamping) in order to demonstrate the versatility of the machine. • Have the students make parts needed for the modules on making assemblies. • Use the machine's checklist and maintenance program to help the students acquire the knowledge and skills related to the responsibilities and maintenance activities of sheet metal workers. 	

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Install the punches and dies and adjust the punch.</p>	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Identification of steps in the manufacturing process • Proper application of data entry procedure • Appropriate choice of material • Accurate interpretation of programming data • Appropriate choice of punches and dies • Full inspection of integrity of punches and dies • Proper positioning of punches and dies • Validation of program • Appropriate use of control panel functions 	<ul style="list-style-type: none"> • See Modules 2, 5 and 13. • Loading the program from a diskette and from a server • Browsing and selecting a file • Numerical control punches and their features • Components of numerical control punches and their respective functions • Identification of axes • Capacity of a numerical control punch • Shapes of punches and dies and their applications • Play between punch and die in accordance with type and thickness of material • Cracks and signs of wear in punches and dies • Adjustment of selectors and interpretation of signal lights: overrun detectors, repositioning detector, etc. • Idle stroke to verify the shock-free travel of punches • Manual programming of a punch (see Module 13)

Specifications	Performance Criteria	Suggested Related Content
C. Perform punching operations.	<ul style="list-style-type: none">• Careful handling of material• Proper use of lubricants• Proper positioning of material• Proper use of control panel functions• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Positioning clips• Types of lubricants and their respective functions• Interpretation of signal lights and messages displayed on screen• Safe use of numerical control punch in terms of the risks and safety measures addressed in Module 7
D. Control the quality of punched parts and make the necessary adjustments.	<ul style="list-style-type: none">• Appropriate choice and use of measuring instruments• Accurate interpretation of measurements• Accurate interpretation of drawing or work order• Full inspection of integrity of material• Correct decision concerning the conformity of the parts with specifications• Appropriate use of control panel functions• Appropriate and accurate corrections made to the manual programming	<ul style="list-style-type: none">• Interpretation of drawings and verification of the dimensions of the parts (see Modules 5 and 6)• Possible manufacturing defects in punched parts: burrs, scratches, etc.• Procedures for correcting programming: finding a program number, editing, addressing, inserting, etc.

Specifications	Performance Criteria	Suggested Related Content
E. Maintain the punch and tools.	<ul style="list-style-type: none">• Appropriate use of checklist and maintenance program• Appropriate cleaning of punches and dies• Proper verification and sharpening of punches and dies• Proper application of maintenance procedure• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Cracks and signs of wear in punches and dies• Tools for sharpening punches and dies and verification instruments• Safe use of sharpening tools

MODULE 15: ADAPTING TO NEW TYPES OF WORK ORGANIZATION			CODE: 872 153 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must adapt to new types of work organization in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working in a team• Given all the information related to the operation of a manufacturing company• Using the relevant documentation• In an atmosphere of respect and openness		

Specifications	Performance Criteria	Suggested Related Content
<p>A. Recognize the production management approaches of the company and their effects on the type of work organization.</p> <p>B. Recognize the means used to promote the continual improvement of productivity.</p>	<ul style="list-style-type: none">• Recognition of the company's management philosophies, such as Taylorism and value-added output• Proper description of the type of structural organization:<ul style="list-style-type: none">- hierarchical organization- semiautonomous teams- autonomous teams• Recognition of the company's production process• Appreciation of the effects on production and on the evolution of tasks in the company <ul style="list-style-type: none">• Accurate differentiation among the instruments or techniques used in the company• Relevant associations between the means used and the company's ability to meet the requirements of the new economy, such as:<ul style="list-style-type: none">- improvement of the time required to respond to market needs- economies of scale- elimination of waste• Recognition of the contribution of personnel to the improvement of productivity	

Specifications	Performance Criteria	Suggested Related Content
C. Communicate verbally with colleagues.	<ul style="list-style-type: none"> • Choice of types of questions required to obtain relevant information • Proper reformulation of areas of agreement and disagreement in a discussion • Proper reformulation and reflection of a message • Constructive and accurate feedback to: <ul style="list-style-type: none"> - encourage improvement in behaviour - recognize and encourage the contribution of colleagues • Relevant and persuasive expression of their point of view • Openness to controversial comments • Use of an effective approach to deal with emotional behaviour 	<ul style="list-style-type: none"> • Communication process • Obstacles to communication • Role of perception and defence mechanisms • Productive attitudes • Types of questions • Reformulation • Reflection • Summary of discussions • Specific feedback based on personal experience • Reaction to emotional behaviour • Arguments supporting an opinion
D. Solve problems related to the organization of work.	<ul style="list-style-type: none"> • Appropriate choice of problem-solving tools and techniques depending on the complexity of the problem to be solved • Clear description of the problem • Determination of the causes and consequences of the problem • Choice of best solution in accordance with established criteria • Realistic plan of action • Clearly defined and scheduled follow-up mechanisms 	<ul style="list-style-type: none"> • Advantages of using a problem-solving process • Simple process • Tools and techniques

Specifications	Performance Criteria	Suggested Related Content
E. Work in a multidisciplinary team.	<ul style="list-style-type: none">• Determination of the goals of the team and the results to be achieved in accordance with the company's mission and values• Consensus on team rules• Determination of the responsibilities of each team member• Appropriate planning of work• Consensus decision making• Recognition of styles of participation• Description of factors favourable and unfavourable to the success of each of the stages in the development of a work team	<ul style="list-style-type: none">• Bases of an effective work team• Cooperation as opposed to competition• Roles within the team• Team rules• Styles of participation• Planning stages• Consensus decision-making process• Stages in the growth of a work team

MODULE 16: SERIAL PRODUCTION OF BENDED PARTS		CODE: 872 656 90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
<p>To demonstrate the required competency, the students must serially produce bended parts in accordance with the following conditions, criteria and specifications.</p>	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel and aluminum - a storage medium or link • Using: <ul style="list-style-type: none"> - a numerical control press brake with three or more axes - punches and dies - a bend chart - measuring instruments and checking templates - storage accessories - a sampling chart - identification materials - a checklist and maintenance program - the operating manual - cleaning products, greases and lubricants 	<ul style="list-style-type: none"> • Coordinate this module with the module on programming cutting and forming machines by running certain programs developed in the earlier module. • Have the students produce parts with several bends on a numerical control press brake requiring three different arrangements of punches and dies in three locations on the ram. • Ensure that the students correctly interpret the drawing and determine the bends to be made at each step. • Help the students develop the necessary psychomotor skills and a concern for productivity. • Use a different identification technique from the ones used in earlier modules. • Use the machine's checklist and maintenance program to help the students acquire the knowledge and skills related to the responsibilities and maintenance activities of sheet metal workers.

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Install the punches and dies and adjust the press brake.</p>	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Identification of steps in the manufacturing process • Proper application of data entry procedure • Appropriate choice of material • Accurate interpretation of programming data • Appropriate choice of punches and dies • Full inspection of integrity of punches and dies • Proper positioning of punches and dies • Accurate alignment of punches and dies • Solid installation of punches and dies • Accurate adjustment of out-of-lock mechanisms • Validation of program • Appropriate use of control panel functions • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See Modules 2, 5 and 13. • Loading the program from a diskette and from a server • Browsing and selecting a file • Numerical control press brakes and their features • Components of press brakes and their respective functions • Number of axes and their identification • Capacity of a press brake • Shapes, radius and angles of punches and dies • Interpretation of bend chart: bend force required in accordance with opening and thickness of material • Uniform wear of machine as a result of the positioning of punches and dies • Punch and die clamps • Cracks and signs of wear in punches and dies • Visual verification of alignment of punches and dies and clamping • Adjustment of out-of-lock mechanisms • Programming of a press brake (see Module 13) • Safe adjustment of press brake in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
C. Bend the first part.	<ul style="list-style-type: none"> Careful handling of material Proper positioning of material Proper application of bending method Observance of bending sequence Proper use of press brake and control panel functions Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Numerical control press brake routines Safe use of press brake in terms of the risks and safety measures addressed in Module 7
D. Verify the conformity of the bended part and make the necessary adjustments.	<ul style="list-style-type: none"> Appropriate choice and use of measuring instruments and checking templates Accurate interpretation of measurements Accurate interpretation of drawing or work order Correct decision concerning the conformity of the part with specifications Appropriate use of control panel functions Appropriate and accurate corrections made to the programming and the adjustment of out-of-lock mechanisms 	<ul style="list-style-type: none"> Checking templates for bended parts Interpretation of drawings and verification of the dimensions of a bended part (see Modules 5 and 6) Possible manufacturing defects in bended parts: curve radius, delamination, scratching, etc. Procedures for correcting the programming of a press brake: finding a program number, editing, addressing, inserting, etc.
E. Set up the work area.	<ul style="list-style-type: none"> Application of methods promoting improved productivity Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Methods promoting improved productivity (see Module 15) Organization of work and uncluttered work areas (see Module 7)

Specifications	Performance Criteria	Suggested Related Content
F. Bend the other parts and ensure quality control.	<ul style="list-style-type: none">• Careful handling of material• Proper positioning of material• Proper application of bending method• Observance of bending sequence• Proper application of sampling and verification procedures• Correct decision concerning the conformity of parts with specifications• Appropriate use of press brake and control panel functions• Observance of productivity standards• Observance of occupational health and safety rules	
G. Finish the work.	<ul style="list-style-type: none">• Proper application of identification procedure• Cleanliness of work area• Appropriate storage of accessories	<ul style="list-style-type: none">• Identification techniques (see Module 8)
H. Maintain the press brake and tools.	<ul style="list-style-type: none">• Appropriate use of checklist and maintenance program• Appropriate cleaning of punches and dies• Proper application of maintenance procedure	

MODULE 17: USING JOB SEARCH TECHNIQUES			CODE: 872 661 15 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must use job search techniques in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given job offers• Using the appropriate documentation and software• In simulated job interviews	<ul style="list-style-type: none">• Have the students collect job offers from various sources.• Analyze and comment on their résumés and covering letters as part of their formative evaluation.• Do role plays and tape the interviews.	

Specifications	Performance Criteria	Suggested Related Content
A. Write a résumé.	<ul style="list-style-type: none"> • Identification of important parts of the job offer • Appropriate and objective information provided • Format in conformity with standards • Observance of rules of grammar and spelling • Clarity 	<ul style="list-style-type: none"> • The job in question and the hiring profile • Sections of a résumé: personal information, education, vocational training, work experience, etc. • Rules for writing a résumé: style, grammar, etc. • Model résumés • Software for writing résumés
B. Write a letter of application.	<ul style="list-style-type: none"> • Text appropriate to the job in question • Observance of formatting standards 	<ul style="list-style-type: none"> • Information likely to interest the reader • Parts of a covering letter • General principles: lively style, short sentences and paragraphs, etc.
C. Prepare for and undergo a job interview.	<ul style="list-style-type: none"> • Appropriate appearance • Attentive attitudes and behaviours • Appropriate, clear statements 	<ul style="list-style-type: none"> • Types of interviews • Hiring criteria • Preparation for the interview: information about the company, personal documents, etc. • Dress adapted to the circumstances • Behaviour and attitudes: introduction, greeting, politeness, discretion, appropriate timing of questions, enthusiasm, etc.

MODULE 18: INTRODUCTION TO THE WORKPLACE			CODE: 872 676 90 hours
Expected Outcome	Instructional Guidelines	Suggested Approach	
<p>By participating in the required activities of the learning context according to the indicated criteria, the students will be able to begin practising the trade.</p> <p>Specifications:</p> <p>Learn about the terms and conditions of the practicum and the necessary prerequisites.</p> <p>Be familiar with the organizational characteristics of a company that hires precision sheet metal workers.</p> <p>Learn about the reality of the trade.</p> <p>See what they have learned and the skills they still need to develop.</p> <p>Think about possibilities for entering the work force.</p>	<ul style="list-style-type: none">• Provide the students with a variety of appropriate documentation.• Maintain close ties between the school and the company.• Provide the students with regular support and supervision.• Encourage the students to share their opinions and express themselves.	<ul style="list-style-type: none">• Introduce this module as different from Module 22 (Workplace Integration).• Review the differences between situational and behavioural objectives.• Prepare an observation checklist for the participation evaluation.	

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 1 Preparation for the practicum</p> <p>Learning about the objectives of the practicum and its terms and conditions</p> <p>Listing their acquired knowledge and skills and relating them to those needed to practise the trade</p> <p>PHASE 2 Participation in the company</p> <p>Visiting the company and learning about its organization</p> <p>Observing work techniques</p> <p>Performing work-related activities corresponding to their skills</p>	<ul style="list-style-type: none"> • Consult the sources of information made available to them. • List their knowledge and skills and explain how they will help them perform trade-related tasks. • Are well-groomed and adopt a positive and polite attitude in communications with workers in the company. • Are punctual and show an interest. • Are intent on following company rules when performing assigned activities. • Record in a log all the work-related activities performed and all the information needed to write their practicum report. • Observe occupational health and safety rules. 	<ul style="list-style-type: none"> • Company and training centre rules governing the practicum • Information about supervision by the teacher • List of program competencies acquired in relation to the tasks and activities to be performed in the workplace • Structure of the company • Working conditions • Rules in effect • Work stations and tasks performed • Attitudes and behaviour: attentiveness, respect, discretion, etc. • Log: activities performed, difficulties encountered, techniques and concepts learned, comments of company personnel, etc.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 3 Evaluation of the practicum</p> <p>Reporting on their experience in the workplace</p>	<ul style="list-style-type: none">• Share their experience with the group and present a report containing:<ul style="list-style-type: none">- information about the company- observations made during the practicum- a description of the work-related activities performed- a comparison of the actual trade with the program of study- their impressions concerning their ability to adapt to the workplace	<ul style="list-style-type: none">• Review of rules governing group discussion: respect for others and the objectives of the discussion• Topics of discussion:<ul style="list-style-type: none">- similarities and differences between companies- time and speed of work-related activities performed- autonomy at work and in school- knowledge, skills, attitudes and behaviours to be acquired or developed, etc.• Practicum report: structure and organization of the company, products manufactured, manufacturing processes, work stations, tasks performed, competencies required to practise the trade and comparisons with those in the program of study, indications of their ability to adapt to the workplace

MODULE 19: OPERATING A LASER CUTTING MACHINE			CODE: 872 685 75 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
<p>To demonstrate the required competency, the students must operate a laser cutting machine in accordance with the following conditions, criteria and specifications.</p>	<ul style="list-style-type: none"> • Working alone • Given: <ul style="list-style-type: none"> - work orders or drawings - sheets of mild steel, stainless steel or aluminum - a storage medium or link • Using: <ul style="list-style-type: none"> - a numerical control laser cutting machine - measuring instruments - a checklist and maintenance program - the operating manual - cleaning products, greases and lubricants 	<ul style="list-style-type: none"> • Coordinate this module with the module on programming cutting and forming machines by running certain programs developed in the earlier module. • Cut out a variety of shapes from different types and thicknesses of material. • Have the students make parts needed for the modules on making assemblies. • Use the machine's checklist and maintenance program to help the students acquire the knowledge and skills related to the responsibilities and maintenance activities of sheet metal workers. 	

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none"> • Accurate interpretation of drawing or work order • Identification of steps in the manufacturing process • Proper application of data entry procedure • Appropriate choice of material 	<ul style="list-style-type: none"> • See Modules 2, 5 and 13. • Loading the program from a diskette and from a server • Browsing and selecting a file
B. Adjust the laser cutting machine.	<ul style="list-style-type: none"> • Accurate interpretation of programming data • Appropriate choice of gas • Proper adjustment of parameters • Validation of program • Appropriate use of control panel functions 	<ul style="list-style-type: none"> • Numerical control laser cutting machines and their features • Components of laser cutting machines and their respective functions • Identification of axes • Capacity of a laser cutting machine • Types of gas and their respective functions • Adjustment of beam, focus, gas pressure and cutting speed and their effects on cutting and drilling • Manual programming of a laser cutting machine (see Module 13)
C. Perform cutting and drilling operations.	<ul style="list-style-type: none"> • Careful handling of material • Proper positioning of material • Appropriate use of control panel functions • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Positioning clips • Interpretation of signal lights and messages displayed on screen • Safe use of laser cutting machine in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
D. Control the quality of cut or drilled parts and make the necessary adjustments.	<ul style="list-style-type: none">• Appropriate choice and use of measuring instruments• Accurate interpretation of measurements• Accurate interpretation of drawing or work order• Full inspection of integrity of material• Correct decision concerning the conformity of parts with specifications• Appropriate use of control panel functions• Appropriate and accurate corrections made to the manual programming and the adjustment of out-of-lock mechanisms	<ul style="list-style-type: none">• Interpretation of drawings and verification of dimensions of cut parts (see Modules 5 and 6)• Possible manufacturing defects in laser cut parts: lack of squareness, burrs, etc.• Procedures for correcting programming: finding a program number, editing, addressing, inserting, etc.• Adjustment of out-of-lock mechanisms: power, focus, etc.
E. Maintain the laser cutting machine.	<ul style="list-style-type: none">• Appropriate use of checklist and maintenance program• Proper application of maintenance procedure• Observance of occupational health and safety rules	

MODULE 20: INSTALLING FASTENERS			CODE: 872 692 30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must install fasteners in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- work orders or drawings- drilled parts made of mild steel, stainless steel or aluminum• Using:<ul style="list-style-type: none">- the appropriate tools- a setting press- punches and dies- fasteners- verification instruments	<ul style="list-style-type: none">• The students could install fasteners on parts made in earlier modules.	

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none"> • Accurate interpretation of symbols, codes and abbreviations • Appropriate determination of operations to be performed 	<ul style="list-style-type: none"> • Identification of fasteners • Types of fasteners (e.g. thread, material, thickness) and their uses
B. Install fasteners using hand tools.	<ul style="list-style-type: none"> • Appropriate choice of fasteners • Appropriate use of tools • Proper positioning of parts • Solid installation of fasteners 	<ul style="list-style-type: none"> • Installation of fasteners by compression and with the use of hand crimpers • Verification of installation using gauges
C. Install fasteners mechanically.	<ul style="list-style-type: none"> • Appropriate choice of fasteners • Appropriate choice and use of tools • Proper positioning of parts • Proper adjustment and use of setting press • Solid installation of fasteners • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Types of setting presses and their features • Components of setting presses and their respective functions • Capacity of a setting press • Shapes of punches and dies • Punch and die clamps • Alignment of punch and die and adjustment of insertion force and stroke • Verification of installation using gauges • Safe use of setting press

MODULE 21: MAKING ASSEMBLIES		CODE: 872 708 120 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must make an assembly in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working in a team• Given:<ul style="list-style-type: none">- assembly drawings and specifications- sheets of mild steel, stainless steel or aluminum• Using:<ul style="list-style-type: none">- cutting and forming machines- the appropriate tools- cleaning products- sealers and glues- fasteners- jigs and checking templates- measuring and verification instruments	<ul style="list-style-type: none">• Review the knowledge and skills needed to interpret assembly drawings (see Module 5).• Choose projects that will help the students integrate and enhance previously acquired specific and general competencies.• Encourage the students to work autonomously.

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none"> • Accurate interpretation of assembly drawings and specifications • Logical sequence of operations • Fair and logical division of tasks and responsibilities • Appropriate choice of material • Respect for the opinions of others • Observance of the company's work organization 	<ul style="list-style-type: none"> • See Modules 2 and 5. • Sequential performance of assembly operations • Work organization (see Module 15)
B. Make the parts.	<ul style="list-style-type: none"> • Careful handling of material • Appropriate choice and use of machine tools • Proper application of safety measures • Proper application of cutting and forming techniques • Proper application of machining techniques • Conformity of parts with specifications • Observance of productivity standards • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See modules on cutting, forming, machining and programming. • Protective coatings for materials • Verification of dimensions of parts (see Module 6) • Safe use of tools and machine tools in terms of the risks and safety measures addressed in Module 7
C. Prepare the surfaces of the parts.	<ul style="list-style-type: none"> • Careful handling of parts • Proper application of cleaning products 	<ul style="list-style-type: none"> • Cleaning products: solvents, soaps, uses, application • Sealers: types of products, uses, preparation, application, verification criteria

Specifications	Performance Criteria	Suggested Related Content
D. Assemble the parts.	<ul style="list-style-type: none"> Careful handling of parts Proper application of machining techniques Use of the appropriate jigs Accurate positioning of parts Proper application of spot-welding, crimping, riveting or gluing techniques Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Types of glues: preparation, application, verification criteria Installation of pop rivets, tog-o-locks, etc. Spot welding and the installation of fasteners (see Modules 9 and 20) Jigs: shapes, materials, locking devices, positioning holes, etc. Positioning and installation sequence of parts and fasteners on jigs, locking devices and tightening sequence, etc. Safe use of assembly tools, spot-welding machine and setting press in terms of the risks and safety measures addressed in Modules 7, 9 and 20
E. Verify the quality of the assembly and make the necessary adjustments.	<ul style="list-style-type: none"> Proper application of verification procedures Accurate interpretation of assembly drawings and specifications Accurate identification of defects Determination of corrective measures Effective application of corrective measures Observance of quality standards 	
F. Finish the work.	<ul style="list-style-type: none"> Proper application of identification method Cleanliness of work area 	

MODULE 22: WORKPLACE INTEGRATION		CODE: 872 716 90 hours
Expected Outcome	Instructional Guidelines	Suggested Approach
<p>By participating in the required activities of the learning context according to the indicated criteria, the students will be able to integrate into a workplace.</p> <p>Specifications:</p> <p>Make contact with employers.</p> <p>Observe and perform work-related activities in the workplace.</p> <p>Learn about the quality standards in effect in the company.</p> <p>Learn about the changes in perception resulting from an experience in the workplace.</p>	<ul style="list-style-type: none"> • Provide the students with the means of choosing a good practicum position. • Maintain close ties between the school and the company. • Make sure the students can observe and perform trade-related tasks. • Ensure that the students are supervised by a responsible person in the company. • Provide the students with regular support and supervision. • Intervene in the event of difficulties or problems. • Encourage the students to share their opinions and express themselves on the choice of a practicum position and on the difference between their initial perceptions and the reality of the workplace. 	<ul style="list-style-type: none"> • Use the log and practicum report from “Introduction to the Workplace” (Module 18) to help the students evaluate their progress in the workplace. • Prepare an observation checklist for the participation evaluation.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 1 Preparation for the practicum</p> <p>Learning about the terms and conditions of the practicum</p> <p>Listing companies likely to help them integrate the competencies acquired during training</p> <p>Taking steps to obtain a practicum position</p> <p>Defining their expectations and needs with respect to the practicum</p>	<ul style="list-style-type: none">• Gather information about the practicum and the organization of the company.• Meet with a company representative in order to obtain a practicum position.• Describe the tasks in question.	<ul style="list-style-type: none">• Company and training centre rules governing the practicum• Information about supervision by the teacher• Sources of information:<ul style="list-style-type: none">- lists of companies- telephone books- employment centres- classified ads- etc.• Personal and career objectives• For preparing for and undergoing an interview, see Module 17.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 2 Observation and performance of activities in the workplace</p> <p>Observing the work context</p> <p>Performing different trade-related tasks or participating in their performance</p> <p>Verifying the satisfaction of the person responsible for the practicum with the activities performed</p> <p>Making observations on the work context and the activities performed</p>	<ul style="list-style-type: none">• Are open, interested and motivated.• Are intent on correctly performing the assigned tasks.• Are intent on observing quality standards.• Follow company rules regarding schedules and occupational health and safety rules.• Record in a log all work-related activities performed and all information needed to write a practicum report.	<ul style="list-style-type: none">• Structure of the company• Working conditions• Rules in effect• Work stations and tasks performed• Attitudes and behaviour: attentiveness, respect, discretion, etc.• Log: activities performed, difficulties encountered, techniques and concepts learned, comments of company personnel, etc.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 3</p> <p>Comparison of initial perceptions with the reality of the trade</p> <p>Comparing their perception of the trade before and after the practicum</p> <p>Discussing the accuracy of their perception of the trade before and after the practicum: workplace, practices</p> <p>Discussing the influence of the experience on their future employment choices</p>	<ul style="list-style-type: none">• Participate in a discussion and present a report on their experience in the workplace, indicating the influence the experience will have on their future employment choices.	<ul style="list-style-type: none">• Review of the rules governing group discussion: respect for people and for the objectives of the discussion• Topics of discussion:<ul style="list-style-type: none">- similarities and differences between companies- time and speed of work-related activities performed- autonomy at work and in school- knowledge, skills, attitudes and behaviours to be acquired or developed, etc.• Practicum report: structure and organization of the company, products manufactured, manufacturing processes, work stations, tasks performed, competencies required to practise the trade and comparisons with those in the program of study, indications of their ability to integrate into the workplace

MODULE 23: INSTALLING AND REMOVING RIVETS AND OTHER FASTENERS			CODE: 872 724 60 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must install and remove rivets and other fasteners in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- work orders or drawings- parts made of stainless steel and aluminum• Using:<ul style="list-style-type: none">- drill charts- the appropriate tools- rivets and other fasteners- measuring and verification instruments	<ul style="list-style-type: none">• Install 3/32" to 3/16" countersunk head and universal head rivets of different lengths.• Install 1/8" to 5/16" fasteners of different lengths.• Install replacement rivets.• Use drill jigs at first, then help the students develop the skill of drilling without a jig.	

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none">• Accurate interpretation of symbols, codes and abbreviations• Appropriate determination of operations to be performed	<ul style="list-style-type: none">• Identification of rivets: type of head, material code, diameter, length• Identification of crimped and threaded fasteners• Location of holes, edge distance and pitch
B. Prepare the parts.	<ul style="list-style-type: none">• Accurate positioning of parts• Solid installation of clamps• Proper positioning of holes• Proper use of lubricants• Appropriate use of tools• Perpendicular and circular holes• Appropriate and accurate boring and chamfering• Quality of deburring• Observance of tolerances• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Clamps: C clamp, vise-grip pliers, Cleco clips, nut clamps, etc.• Manual machining of parts (see Module 11)

Specifications	Performance Criteria	Suggested Related Content
C. Install the rivets.	<ul style="list-style-type: none">• Appropriate choice of rivets• Appropriate choice and use of tools• Proper application of riveting technique• Observance of tolerances• Concern for esthetic appearance• Observance of productivity standards• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Methods of installing rivets: percussion, compression, traction• Riveting tools and accessories: air gun, rivet set, ram, drift punch, Cherry lock riveter, Olympic riveter, Cherry Max riveter, microgrinder, shaving tool, etc.• Techniques: position of parts, tools, accessories and worker• Overrun tolerances• Verification using measuring instruments: depth gauge, shim, etc.• Riveting defects: head defects, seam defects, loose rivets, etc.• Safe use of tools and personal safety equipment during riveting operations
D. Install the fasteners.	<ul style="list-style-type: none">• Appropriate choice of fasteners• Appropriate choice and use of tools• Proper application of installation technique• Proper installation of locking device	<ul style="list-style-type: none">• Methods of installing fasteners: compression, traction• Tools and accessories: hand and air ratchets, torque wrench and nosepieces, riveters, Lock bolt, Jo-bolt, Hi-shear, H-lock, riveters for installing captive nuts, etc.

Specifications	Performance Criteria	Suggested Related Content
E. Remove rivets and other fasteners.	<ul style="list-style-type: none">• Appropriate choice and use of tools• Proper application of deriveting technique• Proper application of disassembly techniques• Integrity of material• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Techniques for removing regular and blind rivets• Extraction of crimped and threaded fasteners• Tools and accessories used to extract rivets and other fasteners: drill, bits, ram, drift punch, riveting punch, drill guide, hand wrench, pliers, air screwdriver, etc.• Safe use of tools for extracting rivets and other fasteners

MODULE 24: ADJUSTING THE SHAPE OF PARTS			CODE: 872 733 45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach	
To demonstrate the required competency, the students must adjust the shape of parts in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- distorted bended, roll-bended, embossed, drawn and punched parts• Using:<ul style="list-style-type: none">- the drawing of the parts- measuring instruments and checking templates- machine tools and the appropriate tools	<ul style="list-style-type: none">• Have the students adjust the shape of bended parts made out of aluminum that have distorted as a result of heat treatment.• Have them adjust the shape of cylindrical parts distorted as a result of welding.• Have them adjust punched parts with unwanted drawing.• Have them adjust the shape of sections.• Use checklists to determine distortions, probable causes, suggested corrective measures, the sequence of operations and the machine tools and tools to be used at each stage.	

Specifications	Performance Criteria	Suggested Related Content
A. Analyze the distortion.	<ul style="list-style-type: none"> • Accurate interpretation of drawing • Proper positioning of part • Appropriate choice and use of measuring instruments and templates • Accurate determination of distortion points or areas • Proper determination of the nature of the distortion 	<ul style="list-style-type: none"> • Interpretation of drawings and verification of dimensions (see Modules 5 and 6) • Types of distortions: hollows, bumps, warping, waving, lack of straightness, etc. • Arrangement of supports • Positioning of parts on assembly squares and jigs • Identification by sight and by touch of distortion points and areas • Full support of part on jig for verification • Use of measuring instruments and verification of flatness, squareness, etc.
B. Determine the adjustment method.	<ul style="list-style-type: none"> • Proper choice of adjustment methods • Logical sequence of corrective measures 	<ul style="list-style-type: none"> • Sequence of tasks for concave, convex, bended and drawn parts, etc. • Adjustments using machine tools (press brake, roll-bending machine, hydraulic puller, etc.) • Adjustments using mallets, hand presses, stretching and upsetting, clamps and clips, etc.
C. Make the adjustments.	<ul style="list-style-type: none"> • Careful handling of part • Proper use of tools or machine tools • Appropriate use of sense of hearing and touch • Attitudes and behaviours demonstrating precision and patience • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • Value of the part and care to be taken • Characteristics of materials (see Module 2) • Trial and error • Safe use of tools and machine tools in terms of the risks and safety measures addressed in Module 7

Specifications	Performance Criteria	Suggested Related Content
D. Control the quality of the adjusted part.	<ul style="list-style-type: none">• Appropriate choice and use of measuring instruments and templates• Accurate interpretation of measurements• Accurate interpretation of drawing• Full inspection of integrity of material• Correct decision concerning the conformity of the part with specifications	<ul style="list-style-type: none">• Checking templates for verifying parts• Interpretation of drawings and verification of dimensions of the part (see Modules 5 and 6)

MODULE 25: MAKING SUBASSEMBLIES		CODE: 872 746 90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must make a subassembly in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working alone• Given:<ul style="list-style-type: none">- assembly drawings and specifications- sheets of stainless steel or aluminum• Using:<ul style="list-style-type: none">- cutting and forming machines- the appropriate tools- cleaning products- sealers and glues- rivets and other fasteners- checking templates- measuring and verification instruments	<ul style="list-style-type: none">• Review the knowledge and skills needed to interpret assembly drawings (Module 5).• Choose projects that will help the students integrate and enhance previously acquired specific and general competencies.• The acquisition of knowledge about aircraft components and the preparation of surfaces should be harmonized with Module 26.• Encourage the students to read technical documentation about aviation.

Specifications	Performance Criteria	Suggested Related Content
<p>A. Plan the work.</p> <p>B. Make the parts and jigs.</p> <p>C. Prepare the surfaces of the parts.</p>	<ul style="list-style-type: none"> • Accurate interpretation of assembly drawing and specifications • Logical sequence of operations • Appropriate choice of material • Careful handling of materials • Appropriate choice and use of machine tools • Proper application of safety measures • Proper application of cutting and forming techniques • Proper application of machining techniques • Parts and jigs in conformity with specifications • Observance of productivity standards • Observance of occupational health and safety rules • Careful handling of parts • Proper application of cleaning products • Proper application of sealers 	<ul style="list-style-type: none"> • See Modules 2 and 5. • Main components of an aircraft • Sequence of assembly operations: clamping, riveting, sealing, etc. • Jigs: shapes, materials, locking devices, positioning holes, etc. • For the production of parts and jigs, see the modules on cutting, forming, machining and programming. • Protective coatings for materials • Verification of dimensions of parts (see Module 6) • Safe use of tools and machine tools in terms of the risks and safety measures addressed in Module 7 • Cleaning products: solvents, soaps, uses, application • Sealers: types of products, uses, preparation, application, verification criteria

Specifications	Performance Criteria	Suggested Related Content
D. Assemble the parts.	<ul style="list-style-type: none">• Careful handling of parts• Proper application of machining techniques• Use of the appropriate jigs• Accurate positioning of parts• Proper application of techniques for spot welding, installing rivets and other fasteners, or gluing• Observance of occupational health and safety rules	<ul style="list-style-type: none">• Types of glues: preparation, application, verification criteria• Spot welding and the installation of rivets and other fasteners (see Modules 9 and 23)• Positioning and installation sequence of parts and fasteners on jigs, locking devices and tightening sequence, etc.• Safe use of assembly tools and spot-welding machine in terms of the risks and safety measures addressed in Modules 7 and 9
E. Verify the quality of the subassembly and make the necessary adjustments.	<ul style="list-style-type: none">• Proper application of verification procedures• Accurate interpretation of assembly drawings and specifications• Accurate identification of defects• Determination of corrective measures• Effective application of corrective measures• Observance of quality standards	
F. Finish the work.	<ul style="list-style-type: none">• Proper application of identification method• Cleanliness of work area	

MODULE 26: MAKING ASSEMBLIES		CODE: 872 758 120 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
To demonstrate the required competency, the students must make an assembly in accordance with the following conditions, criteria and specifications.	<ul style="list-style-type: none">• Working in a team• Given:<ul style="list-style-type: none">- assembly drawings and specifications- sheets of stainless steel or aluminum- subassemblies• Using:<ul style="list-style-type: none">- cutting and forming machines- the appropriate tools- cleaning products- sealers and glues- rivets and other fasteners- jigs and checking templates- measuring and verification instruments	<ul style="list-style-type: none">• Have the students make assemblies using the subassemblies produced in Module 25.• Coordinate the interpretation of assembly drawings, the acquisition of knowledge about aircraft components and the preparation of surfaces with Module 25.• Encourage the students to work autonomously.• Encourage the students to read technical documentation about aviation.

Specifications	Performance Criteria	Suggested Related Content
A. Plan the work.	<ul style="list-style-type: none"> • Accurate interpretation of assembly drawings and specifications • Logical sequence of operations • Fair and logical division of tasks and responsibilities • Appropriate choice of material • Respect for the opinions of others • Observance of the company's work organization 	<ul style="list-style-type: none"> • Main components of an aircraft • See Modules 2 and 5. • Sequential performance of assembly operations given subassemblies and hardware: clamping, riveting, sealing, etc. • Work organization (see Module 15)
B. Make the hardware.	<ul style="list-style-type: none"> • Careful handling of material • Appropriate choice and use of machine tools • Proper application of safety measures • Proper application of cutting and forming techniques • Proper application of machining techniques • Conformity of parts with specifications • Observance of productivity standards • Observance of occupational health and safety rules 	<ul style="list-style-type: none"> • See modules on cutting, forming, machining and programming. • Protective coatings for materials • Verification of dimensions of parts (see Module 6) • Safe use of tools and machine tools in terms of the risks and safety measures addressed in Module 7
C. Prepare the surfaces of the parts and subassemblies.	<ul style="list-style-type: none"> • Careful handling of parts • Proper application of cleaning products • Proper application of sealers 	<ul style="list-style-type: none"> • Cleaning products: solvents, soaps, uses, application • Sealers: types of products, uses, preparation, application, verification criteria

Specifications	Performance Criteria	Suggested Related Content
D. Assemble the parts and subassemblies.	<ul style="list-style-type: none"> Careful handling of parts and subassemblies Proper application of machining techniques Use of the appropriate jigs Accurate positioning of parts and subassemblies Proper application of techniques for spot welding, installing rivets and other fasteners, or gluing Observance of occupational health and safety rules 	<ul style="list-style-type: none"> Types of glues: preparation, application, verification criteria Spot welding and the installation of rivets and other fasteners (see Modules 9 and 23) Position and coordination of workers for installing rivets Positioning and installation sequence of parts, fasteners and subassemblies on jigs, locking devices and tightening sequence, etc. Safe use of assembly tools and spot-welding machine in terms of the risks and safety measures addressed in Modules 7 and 9
E. Verify the quality of the final assembly and make the necessary adjustments.	<ul style="list-style-type: none"> Proper application of verification procedures Accurate interpretation of assembly drawings and specifications Accurate identification of defects Determination of corrective measures Effective application of corrective measures Observance of quality standards 	
F. Finish the work.	<ul style="list-style-type: none"> Proper application of identification method Cleanliness of work area 	

MODULE 27: WORKPLACE INTEGRATION		CODE: 872 776 90 hours
Expected Outcome	Instructional Guidelines	Suggested Approach
<p>By participating in the required activities of the learning context according to the indicated criteria, the students will be able to integrate into a workplace.</p> <p>Specifications:</p> <p>Make contact with employers.</p> <p>Observe and perform work-related activities in the workplace.</p> <p>Learn about the quality standards in effect in the company.</p> <p>Learn about the changes in perception resulting from an experience in the workplace.</p>	<ul style="list-style-type: none"> • Provide the students with the means of choosing a good practicum position. • Maintain close ties between the school and the company. • Make sure the students can observe and perform trade-related tasks. • Ensure that the students are supervised by a responsible person in the company. • Provide the students with regular support and supervision. • Intervene in the event of difficulties or problems. • Encourage the students to share their opinions and express themselves on the choice of a practicum position and on the difference between their initial perceptions and the reality of the workplace. 	<ul style="list-style-type: none"> • Review the differences between situational and behavioural objectives. • Prepare an observation checklist for the participation evaluation.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 1 Preparation for the practicum</p> <p>Learning about the terms and conditions of the practicum</p> <p>Listing companies likely to help them integrate the competencies acquired during training</p> <p>Taking steps to obtain a practicum position</p> <p>Defining their expectations and needs with respect to the practicum</p>	<ul style="list-style-type: none">• Gather information about the practicum and the organization of the company.• Meet with a company representative in order to obtain a practicum position.• Describe the tasks in question.	<ul style="list-style-type: none">• Company and training centre rules governing the practicum• Information about supervision by the teacher• List of program competencies acquired in relation to the tasks and activities to be performed in the workplace• Sources of information:<ul style="list-style-type: none">- lists of companies- telephone books- employment centres- classified ads- etc.• Personal and career objectives• For preparing for and undergoing an interview, see Module 17.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 2 Observation and performance of activities in the workplace</p> <p>Observing the work context</p> <p>Performing different trade-related tasks or participating in their performance</p> <p>Verifying the satisfaction of the person responsible for the practicum with the activities performed</p> <p>Making observations on the work context and the activities performed</p>	<ul style="list-style-type: none">• Are open, interested and motivated.• Are intent on correctly performing the assigned tasks.• Are intent on observing quality standards.• Follow company rules regarding schedules and occupational health and safety rules.• Record in a log all work-related activities performed and all information needed to write a practicum report.	<ul style="list-style-type: none">• Structure of the company• Working conditions• Rules in effect• Work stations and tasks performed• Attitudes and behaviour: attentiveness, respect, discretion, etc.• Log: activities performed, difficulties encountered, techniques and concepts learned, comments of company personnel, etc.

Learning Context	Participation Criteria	Suggested Related Content
<p>PHASE 3</p> <p>Comparison of initial perceptions with the reality of the trade</p> <p>Comparing their perception of the trade before and after the practicum</p> <p>Discussing the accuracy of their perception of the trade before and after the practicum: workplace, practices</p> <p>Discussing the influence of the experience on their future employment choices</p>	<ul style="list-style-type: none">• Participate in a discussion and present a report on their experience in the workplace, indicating the influence the experience will have on their future employment choices.	<ul style="list-style-type: none">• Review of the rules governing group discussion: respect for people and for the objectives of the discussion• Topics of discussion:<ul style="list-style-type: none">- similarities and differences between companies- time and speed of work-related activities performed- autonomy at work and in school- similarities and differences between aspects of the trade and the training received- knowledge, skills, attitudes and behaviours to be acquired or developed, etc.• Practicum report: structure and organization of the company, products manufactured, manufacturing processes, work stations, tasks performed, competencies required to practise the trade and comparisons with those in the program of study, indications of their ability to integrate into the workplace

