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Vocational Education Program

5760

Industrial Construction and Maintenance Mechanics

Training Sector

14

Maintenance
Mechanics

Vocational Education Program

5760

Industrial Construction and Maintenance Mechanics

Training Sector

14

Maintenance
Mechanics

Formation professionnelle et technique
et formation continue

Direction générale des programmes
et du développement

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MAINTENANCE MECHANICS

INDUSTRIAL CONSTRUCTION AND MAINTENANCE MECHANICS

PROGRAM OF STUDY
5760

The *Industrial Construction and Maintenance Mechanics* program leads to the Diploma of Vocational Studies (DVS) and prepares the student to work as a **maintenance mechanic**.

**Direction générale des programmes et
du développement**

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INTRODUCTION

The *Industrial Construction and Maintenance Mechanics* program is based on a framework for developing vocational education 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, aims, 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 *Industrial Construction and Maintenance Mechanics* 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, the SPR 06 test in the language of instruction and MTH-4068-1, or their equivalents, are prescribed as functional prerequisites.

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 education 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 duration of the program is 1800 hours, which includes 855 hours spent on the specific competencies required to practise the trade and 945 hours on general competencies. The program of study is divided into 29 modules, which vary in length from 15 to 120 hours (multiples of 15). 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 training plan. It is broken down into five chapters: the first is a synoptic table of basic information about the

modules; the second defines the program training goals; the third, the competencies to be developed; the fourth, the general objectives, the fifth chapter explains the operational objectives and the sixth chapter covers harmonization. Part II is designed primarily for those directly involved in implementing the program. It contains a description of the operational objective of each module.

GLOSSARY

Program Training Goals

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

Competency

A set of socioaffective behaviours, cognitive skills or psychosensorimotor skills that enable a person to correctly perform a role, function, activity or task.

General Objectives

Instructional objectives that provide an orientation for leading the students to attain one or more related objectives.

Operational Objectives

Statements of the educational aims of a program in practical terms. They serve as the basis for teaching, learning and evaluation.

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:	29	Industrial Construction and Maintenance Mechanics
Duration in hours:	1800	Code: 5760
Credits:	120	

CODE	TITLE OF MODULE	HOURS	CREDITS*
898 201	1 The Trade and the Training Process	15	1
898 212	2 Drawing Sketches and Diagrams	30	2
898 224	3 Interpreting Drawings, Specifications and Technical Documentation	60	4
755 002	4 Health and Safety on Construction Sites	30	2
898 242	5 Using Measuring Instruments	30	2
898 255	6 Performing Manual Machining Operations	75	5
898 262	7 Performing Lubrication Operations	30	2
898 272	8 Using Lifting and Handling Techniques	30	2
898 283	9 Performing Operations Related to the Removal, Installation and Adjustment of Shafts, Bearings and Bushings	45	3
898 297	10 Maintaining and Repairing Transmission and Motion Transformation Components and Devices	105	7
898 303	11 Working With Tubes, Pipes and Hoses	45	3
898 314	12 Using Alignment Techniques	60	4
898 325	13 Maintaining and Repairing Industrial Pumps and Motors	75	5
898 336	14 Checking the Electrical Components of Industrial Production Equipment	90	6
898 345	15 Maintaining, Repairing and Adjusting Vacuum Pumps, Pneumatic Motors and Compressors	75	5
898 358	16 Assembling, Maintaining and Repairing Hydraulic and Electrohydraulic Circuits	120	8
898 365	17 Assembling, Maintaining and Repairing Pneumatic and Electropneumatic Circuits	75	5
898 373	18 Using Static and Dynamic Balancing Techniques	45	3
898 384	19 Using Logical Diagnostic Procedures	60	4
898 396	20 Troubleshooting Automated Systems	90	6
898 403	21 Using Vibration Analysis Techniques	45	3
898 416	22 Performing Machining Operations Using Machine Tools	90	6
898 428	23 Performing Cutting and Welding Operations	120	8
898 432	24 Performing Metal Forming Operations	30	2
898 444	25 Applying a Preventive and Prospective Maintenance Program for Industrial Equipment	60	4
898 451	26 Using Job Search Techniques	15	1
898 466	27 Installing Industrial Equipment	90	6
898 475	28 Troubleshooting Industrial Equipment	75	5
898 486	29 Doing a Practicum in the Workplace	90	6

* 15 hours = 1 credit

2 PROGRAM TRAINING GOALS

The training goals of the *Industrial Construction and Maintenance Mechanics* program are based on the general goals of vocational education and take into account the specific nature of the trade. These goals are:

To develop effectiveness in the practice of a trade.

- To teach students to perform industrial construction and maintenance mechanics tasks and activities—i.e. the maintenance, repair and installation of industrial equipment—correctly and at an acceptable level of competence for entry into the job market.
- To prepare students to progress satisfactorily on the job by fostering:
 - the skills needed to interpret drawings, specifications and technical documentation
 - the skills needed to diagnose malfunctions in industrial equipment
 - the skills needed to make appropriate choices when performing tasks
 - the skills needed to organize and plan their work
 - a constant concern for the strict application of occupational health and safety rules in the performance of their duties
 - a sense of professional ethics
 - the ability to establish harmonious relations and to communicate effectively at work
 - a habit of checking the quality of their work
 - the reinforcement of habits of care and precision in their work
 - the reinforcement of habits of neatness and cleanliness

To ensure integration into the work force.

- To familiarize students with:
 - the job market in general
 - the maintenance mechanics sector
 - the trade of maintenance mechanic
 - the nature of the program, its requirements and conditions, and in-service training possibilities

To foster personal and professional development.

- To help students:
 - develop autonomy, initiative and a sense of responsibility in their work
 - develop their desire for success
 - develop their concern for excellence and the quality of finished products
 - understand the principles underlying the techniques used (cutting, metal forming, welding, manual machining, machining using machine tools, alignment, lubrication, vibration analysis, lifting and handling)
 - acquire the appropriate work methods and a sense of discipline

To ensure job mobility.

- To help students:
 - acquire a solid basic education so that they can demonstrate versatility in the performance of tasks
 - improve their ability to learn, locate information and consult documentation
 - develop positive attitudes toward technological change and new situations
 - prepare for a dynamic job search
 - acquire an accurate perception of career opportunities in maintenance mechanics

3 COMPETENCIES

The competencies to be developed in *Industrial Construction and Maintenance Mechanics* 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 (\odot) 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

GRID OF LEARNING FOCUSES	WORK PROCESS (major steps)						GENERAL COMPETENCIES (related to technology, subjects, personal development, etc.)															TOTALS															
	FIRST-LEVEL OPERATIONAL OBJECTIVES						DURATION (IN HOURS)	Draw sketches and diagrams	Interpret drawings, specifications and technical documentation	Apply concepts related to health and safety on construction sites	Use measuring instruments	Perform manual machining operations	Perform lubrication operations	Use lifting and handling techniques	Perform operations related to the removal, installation and adjustment of shafts, bearing and bushings	Work with tubes, pipes and hoses	Use alignment techniques	Check the electrical components of industrial production equipment	Use static and dynamic balancing techniques	Use logical diagnostic procedures	Use vibration analysis techniques	Perform machining operations using machine tools	Perform cutting and welding operations	Perform metal forming operations	Use job search techniques	NUMBER OF OBJECTIVES	DURATION (IN HOURS)										
								2	3	4	5	6	7	8	9	11	12	14	18	19	21	22	23	24	26												
INDUSTRIAL CONSTRUCTION AND MAINTENANCE MECHANICS	S						15	△																													
	B						105	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	○	○	○	○	○	○	○	○	○	○	○						
	B						75	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					
	B						75	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				
	B						120	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				
	B						75	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
	B						90	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		
	B						60	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	
	B						90	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	B						75	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	S						90	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	NUMBER OF OBJECTIVES						11																														
DURATION (IN HOURS)						870																															

△ Situational objective
▲ Behavioural objective

△ 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 *Industrial Construction and Maintenance Mechanics* program are presented below, along with the major statement of each corresponding first-level operational objective.

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.
- Apply concepts related to health and safety on construction sites.
- Use job search techniques.
- Do a practicum in the workplace.

To develop in the students the competencies required to interpret drawings, specifications and other technical documentation.

- Draw sketches and diagrams.
- Interpret drawings, specifications and technical documentation.

To develop in the students the competencies required to diagnose malfunctions in equipment.

- Use logical diagnostic procedures.
- Use vibration analysis techniques.

To develop in the students the competencies required to apply the techniques needed to practise the trade.

- Use measuring instruments.
- Perform manual machining operations.
- Perform lubrication operations.
- Use lifting and handling techniques.
- Perform operations related to the removal, installation and adjustment of shafts, bearings and bushings.
- Work with tubes, pipes and hoses.
- Use alignment techniques.
- Check the electrical components of industrial production equipment.
- Use static and dynamic balancing techniques.
- Perform machining operations using machine tools.
- Perform cutting and welding operations.
- Perform metal forming operations.

To develop in the students the competencies required to maintain, repair and install industrial equipment.

- Maintain and repair transmission and motion transformation components and devices.
- Maintain and repair industrial pumps and motors.
- Maintain, repair and adjust vacuum pumps, pneumatic motors and compressors.
- Assemble, maintain and repair hydraulic and electrohydraulic circuits.
- Assemble, maintain and repair pneumatic and electropneumatic circuits.
- Troubleshoot automated systems.
- Apply a preventive and prospective maintenance program for industrial equipment.
- Install industrial equipment.
- Troubleshoot industrial equipment.

5 OPERATIONAL OBJECTIVES

5.1 DEFINITION

A first-level operational objective is defined for each competency to be developed in accordance with its description in Chapter 3. 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.

First-level 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.

Second-level operational objectives are intermediate teaching/learning targets deemed prerequisite for attaining first-level objectives. They are grouped according to the specifications (see 5.2 A) or the phases (see 5.2 B) of the first-level objective.

The division of operational objectives into first- and second-level objectives is based on a clear distinction between the levels of learning:

- learning involving prerequisite knowledge
- learning involving competencies

Second-level operational objectives indicate prerequisite knowledge. They prepare the students to learn what is necessary to attain the first-level operational objectives, which collectively lead to the development of a competency. The objectives should always be adapted to meet the particular needs of the individual students or groups of students.

First-level operational objectives cover the learning that the students need to develop a competency:

- The specifications or the phases of the objective determine or guide specific learning, thereby allowing the competency to be developed step by step.
- The objective as a whole (i.e. the six components and in particular the last phase of a situational objective—see 5.2) determines or guides the overall learning and the integration and synthesis of this learning, allowing the competency to be developed fully.

To attain the objectives, the following learning activities may be prepared:

- specific learning activities for second-level objectives
- specific learning activities for the specifications or phases of first-level objectives
- general learning activities for first-level objectives

5.2 HOW TO READ FIRST-LEVEL OPERATIONAL OBJECTIVES

A. How to Read a Behavioural Objective

Behavioural objectives consist of six components. The first three 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 the students can or must do during the 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 **general performance criteria** define the requirements by which to judge whether or not the results obtained are generally satisfactory.

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 **specific 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, *if applicable*. It indicates cases where the objective applies to one or more tasks, occupations, fields, and so on.

B. How to Read a Situational Objective

Situational objectives consist of six components.

- 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 competency. It is normally divided into three phases of learning:
 - information
 - performance, practice or involvement
 - synthesis, integration and self-evaluation

- The **instructional guidelines** suggest 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, which are usually related to each phase of the learning context. 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, *if applicable*. It indicates cases where the objective applies to one or more tasks, occupations, fields and so on.

6 HARMONIZATION

The objective of harmonization is to optimize the efforts of students, allowing them to move from one program to another or from one level of instruction to another without repeating the same courses. The *Industrial Construction and Maintenance Mechanics* program was designed and developed as part of a project to harmonize different programs.

The table of equivalents will be published separately.

Part II

MODULE 1: THE TRADE AND THE TRAINING PROCESS

Code: 898 201

Duration: 15 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE

EXPECTED OUTCOME

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.**

SPECIFICATIONS

During this module, the students will:

- Become familiar with the nature of the trade.
- Understand the training process.
- Assess their career choice.

LEARNING CONTEXT

PHASE 1: Information on the Trade

- Learning about the job market in the field of industrial construction and maintenance mechanics: types of businesses, types of products manufactured or services offered, job prospects, remuneration and advancement opportunities.
- Learning about the nature and requirements of the job: tasks, working conditions, regulations and standards.
- Presenting the information gathered and discussing as a group their views on the trade: advantages, disadvantages, requirements.

PHASE 2: Information on and Participation in the Training Process

- Discussing the skills, attitudes, aptitudes and knowledge required to practise the trade.
- Discussing how the training program prepares students to practise the trade of maintenance mechanic.
- Sharing their views on the training process.

**FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE (cont.)**

PHASE 3: Evaluation and Confirmation of Career Choice

- Producing a report in which they:
 - state how their preferences, aptitudes and interests relate to maintenance mechanics
 - evaluate their career choice by comparing the aspects and requirements of the trade with their preferences, aptitudes and interests

INSTRUCTIONAL GUIDELINES

The teacher should:

- Create a climate that favours the students' personal development and entry into the work force.
- Encourage all students to engage in discussions and express their opinions.
- Motivate students to participate in the proposed activities.
- Help students to arrive at an accurate perception of the trade.
- Provide students with the means to assess their career choice honestly and objectively.
- Organize visits to businesses representative of the field of maintenance mechanics.
- Provide the students with pertinent reference materials: information on the trade, training programs, guides, etc.
- Organize meetings with specialists in the field.

PARTICIPATION CRITERIA

- PHASE 1:**
- Gather information on most of the topics to be covered.
 - Express their views on the trade during a group discussion, relating these views to the information they have gathered.
- PHASE 2:**
- Give their opinions on some of the requirements they will have to meet in order to practise the trade.
 - Carefully review the documentation provided.
 - Listen attentively to the explanations given.
 - Express their views on the training program during a group discussion, relating these views to the trade.
- PHASE 3:**
- Produce a brief report in which they:
 - sum up their preferences, interests and aptitudes
 - explain their career choice by clearly relating these preferences, interests and aptitudes to the practice of the trade
 - explain why they chose to continue or abandon the training program

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before undertaking the activities of Phase 1 (Information on the Trade):

1. Determine their suitability for the targeted competency and the proposed training process.
2. Locate information.
3. Distinguish among tasks, operations and positions.
4. Distinguish among the different rules and standards governing maintenance mechanics in the construction sector.

Before undertaking the activities of Phase 2 (Information on and Participation in the Training Process):

5. Distinguish among the skills, aptitudes, attitudes and knowledge required to practise the trade.
6. Describe the nature, purpose and content of a program of study.

Before undertaking the activities of Phase 3 (Evaluation and Confirmation of Career Choice):

7. Describe the main elements of a report confirming their career choice.

MODULE 2: DRAWING SKETCHES AND DIAGRAMS

Code: 898 212

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **draw sketches and diagrams** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - instructions
 - specifications
 - assembly and detail drawings
 - reference manuals
- Using:
 - pencils and templates
 - equipment

GENERAL PERFORMANCE CRITERIA

- Observance of techniques
- Compliance with standards
- Accurate representation of all dimensions
- Neat, careful work
- Observance of ergonomic principles

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Draw lines and geometric shapes.
- B. Interpret:
- isometric or oblique projections
 - orthogonal projections
 - sectional views (total or partial)
 - simple auxiliary views

SPECIFIC PERFORMANCE CRITERIA

- Observance of drawing technique and method
- Accurate interpretation

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| <p>C. Sketch the following views of a part freehand:</p> <ul style="list-style-type: none">▪ orthogonal projection▪ sectional view▪ isometric projection▪ simple auxiliary views | <p>— Compliance with drawing standards (arrangement and selection of views, proportions, etc.)</p> <p>— Correct dimensioning</p> <p>— Neat sketching</p> |
| <p>D. Draw the following diagrams freehand:</p> <ul style="list-style-type: none">▪ pieces or parts of equipment▪ mechanical transmission▪ piping system | <p>— Usage of symbols and elements of mechanical and piping systems</p> <p>— Proper arrangement of elements</p> |
| <p>E. Dimension the sketches and diagrams in the two systems of measurement (imperial and metric).</p> | <p>— Proper arrangement of dimensions</p> <p>— Number of dimensions sufficient for a clear sketch or diagram</p> <p>— Proper inscription of dimensions</p> |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to draw lines and geometric shapes (A):

1. Draw block letters and numbers freehand.
2. Be familiar with the different types of lines.
3. Distinguish among the different drawing instruments.

Before learning how to interpret:

- **isometric or oblique projections**
- **orthogonal projections**
- **sectional views (total or partial)**
- **simple auxiliary views (B):**

4. Be familiar with the standards related to orthogonal projections.
5. Be familiar with the symbols used to represent materials.
6. Be familiar with the different types of sectional views.
7. Distinguish among the different hatching lines used to represent materials in sectional views.

Before learning how to sketch the following views of a part freehand:

- **orthogonal projection**
- **sectional view**
- **isometric projection**
- **simple auxiliary views (C):**

8. Be familiar with drawing standards.
9. Show concern for the neatness and clarity of the sketches and diagrams.

Before learning how to draw the following diagrams freehand:

- **pieces or parts of equipment**
- **mechanical transmission**
- **pipng system (D):**

10. Be familiar with the symbols used to represent the main machine parts.
11. Be familiar with the main symbols used to represent piping.

Before learning how to dimension the sketches and diagrams in the two systems of measurement (imperial and metric) (E):

12. Be familiar with the units of measurement used in the two systems.
13. Understand the annotations used in drawings.

MODULE 3: INTERPRETING DRAWINGS, SPECIFICATIONS AND TECHNICAL DOCUMENTATION

Code: 898 224

Duration: 60 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **interpret drawings, specifications and technical documentation** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - mechanical building specifications
 - manufacturers' manuals
 - mechanical parts distributors' manuals in English and French
 - reference manuals, such as *Machinery's Handbook*
 - electronic catalogues
 - a detail or assembly drawing, an exploded view, a sectional view, an auxiliary view and an isometric view including industrial materials, threaded and unthreaded fasteners, metal structural parts, mechanical components, dimensions and annotations
- Using a calculator

GENERAL PERFORMANCE CRITERIA

- Observance of techniques
- Compliance with standards
- Accurate representation of all dimensions
- Neat, careful work
- Observance of ergonomic principles

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| <p>A. Interpret mechanical drawings including:</p> <ul style="list-style-type: none"> ▪ orthogonal projections ▪ sectional views ▪ auxiliary views ▪ exploded views ▪ isometric views ▪ title blocks, scales, dimensions and annotations ▪ processes | <p>— Accurate interpretation</p> |
| <p>B. Interpret information in a drawing related to the following:</p> <ul style="list-style-type: none"> ▪ threaded and unthreaded fasteners ▪ mechanical components ▪ industrial materials ▪ metal structural elements | <p>— Accurate interpretation
— Use of proper terminology</p> |
| <p>C. Calculate:</p> <ul style="list-style-type: none"> ▪ dimensions ▪ surfaces ▪ volumes ▪ speeds ▪ allowances and tolerances | <p>— Precise calculations</p> |
| <p>D. Gather information related to the following from technical documentation:</p> <ul style="list-style-type: none"> ▪ lubrication of equipment ▪ installation, startup or storage of equipment ▪ adjustments necessary when assembling and disassembling equipment ▪ replacement parts ▪ suggested preventive maintenance | <p>— Relevant information gathered
— Observance of techniques for locating information
— Use of appropriate documents (data sheets, manufacturers' manuals, specifications, etc.)</p> |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret mechanical drawings including:

- **orthogonal projections**
- **sectional views**
- **auxiliary views**
- **exploded views**
- **isometric views**
- **title blocks, scales, dimensions and annotations**
- **processes (A):**
 1. Recognize orthogonal projections and sectional, auxiliary, exploded and isometric views.
 2. Be familiar with the standardized dimensioning symbols.
 3. Describe the nature of the information contained in a title block.
 4. Understand scales, information about dimensions and annotations.
 5. Describe a process.
 6. Explain the methods of locating information in a drawing.
 7. Understand the concept of allowances and tolerances.

Before learning how to interpret information in a drawing related to the following:

- **threaded and unthreaded fasteners**
- **mechanical components**
- **industrial materials**
- **metal structural elements (B):**
 8. Distinguish among the main threaded and unthreaded fasteners and mechanical components (bearings, gears, chains, belts, etc.) and explain their function.
 9. Be familiar with the symbols used to represent threaded and unthreaded fasteners and mechanical components.
 10. Distinguish among the main industrial materials and describe their characteristics.
 11. Be familiar with the main types of structural shapes and their applications.
 12. Be familiar with the terminology.

SECOND-LEVEL OPERATIONAL OBJECTIVES *(cont.)*

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to calculate:

- **dimensions**
- **surfaces**
- **volumes**
- **speeds**
- **allowances and tolerances (C):**
 13. Be familiar with the two systems of measurement (imperial and metric).
 14. Be familiar with the formulas used to calculate dimensions, surfaces, volumes, speeds, allowances and tolerances.

Before learning how to gather information related to the following from technical documentation:

- **lubrication of equipment**
- **installation, startup or storage of equipment**
- **adjustments necessary when assembling and disassembling equipment**
- **replacement parts**
- **suggested preventive maintenance (D):**
 15. Be familiar with the different types of technical documents used in industrial construction and maintenance mechanics.
 16. Explain the techniques used to locate information in a technical document.
 17. Interpret a mechanical drawing.
 18. Read in English and French.

MODULE 4: HEALTH AND SAFETY ON CONSTRUCTION SITES

Code: 755 002

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE

EXPECTED OUTCOME

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to **apply concepts related to health and safety on construction sites.**

SPECIFICATIONS

At the end of this module, the students will:

- Be familiar with the laws and regulations governing health and safety on construction sites.
- Be familiar with the roles and responsibilities of safety representatives and safety officers.
- Be familiar with the hazards and safety measures related to the performance of certain tasks.
- Be familiar with the hazards and safety measures related to the construction site itself.
- Be familiar with the hazards and safety measures related to the use of certain products.
- Know what to do in the event of an accident.

LEARNING CONTEXT

PHASE 1: Information

- Becoming familiar with the objective of the unit and companion guide.

PHASE 2: Learning

- Gathering information on the topic covered.
- Forming and expressing opinions on the topic.
- Asking questions.
- Identifying the main concepts and the underlying principles of safe behaviour.
- Assessing their adherence to these principles.

**FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE (cont.)**

PHASE 3: Reinforcement

- Reviewing the main concepts of the unit.
- Answering a series of questions.
- Correcting the answers and discussing them if necessary.

INSTRUCTIONAL GUIDELINES

The teacher should:

- Ensure access to a suitable room and the appropriate materials.
- Present the material in an interesting manner.
- Encourage students to participate in group discussions.
- Make good use of teaching materials (e.g. tables, transparencies, films, videotapes, data sheets).

PARTICIPATION CRITERIA

- Participate in at least 18 of the 20 units, units 1 and 2 being compulsory.
- Listen attentively.
- Stick to the topic during discussions.
- Ask pertinent questions and give appropriate answers.
- Do the exercises conscientiously.
- Correct any errors.

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before undertaking the activities of Phase 1 (Information):

1. Be receptive to information related to occupational health and safety.
2. Be willing to share their knowledge with the other members of the group.
3. Understand the importance of occupational health and safety.

Before undertaking the activities of Phase 2 (Learning):

4. Determine a way of locating and recording essential information on each of the topics covered.
5. Describe the main rules governing group discussion.

Before undertaking the activities of Phase 3 (Reinforcement):

6. Describe the main elements of a report confirming their view of occupational health and safety as it relates to the work of maintenance mechanics.

MODULE 5: USING MEASURING INSTRUMENTS

Code: 898 242

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use measuring instruments** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - instructions
 - sketches and drawings
- Using:
 - measuring and control instruments
 - measurement standards
 - industrial equipment
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with standards
- Consistently careful and neat work
- Concern for quality and precision
- Proper use of measuring and control instruments

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Interpret the instructions.

B. Do calculations related to the allowances and tolerances of shapes, positions and dimensions.

SPECIFIC PERFORMANCE CRITERIA

— Accurate interpretation of drawings and specifications

— Precise calculations

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| C. Select measuring and control instruments. | — Appropriate selection of all the necessary measuring instruments for the job and level of precision required |
| D. Calibrate measuring instruments. | — Accurate calibration
— Observance of calibration techniques |
| E. Measure and control different-shaped parts. | — Precise control of parts
— Accurate measurements taken |
| F. Check the compliance of parts. | — Thorough and accurate verification of the compliance of dimensions, shapes and positions |
| G. Tidy up the work area. | — Storage of tools and equipment
— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate the instructions related to measurement.
2. Be familiar with the rules for dimensioning shapes and positions.

Before learning how to do calculations related to the allowances and tolerances of shapes, positions and dimensions (B):

3. Be familiar with the methods of calculating the allowances and tolerances used in the two systems of measurement.

Before learning how to select measuring and control instruments (C):

4. Recognize measuring and control instruments.

Before learning how to calibrate measuring instruments (D):

5. Explain the methods of calibrating measuring instruments.

Before learning how to measure and control different-shaped parts (E):

6. Explain how to use measuring and control instruments.
7. Describe measuring and control methods.

Before learning how to check the compliance of parts (F):

8. Be familiar with the measuring and control tolerances of the dimensions and positions of parts in the two systems of measurement.

MODULE 6: PERFORMING MANUAL MACHINING OPERATIONS

Code: 898 255

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform manual machining operations** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - instructions or work orders
 - drawings and sketches
 - charts or tables
 - reference manuals
- Using:
 - ferrous and nonferrous materials
 - industrial equipment
 - tools, accessories and devices
 - measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Consistently careful and precise work
- Concern for total quality
- Concern for price-quality ratio

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|---|
| A. Interpret the instructions. | <ul style="list-style-type: none"> — Accurate interpretation of instructions — Accurate interpretation of information related to machining in drawings, sketches, tables and charts |
| B. Do calculations related to manual machining operations. | <ul style="list-style-type: none"> — Precise calculations |
| C. Prepare the work area: <ul style="list-style-type: none"> ▪ select the tools, accessories and devices ▪ select the materials | <ul style="list-style-type: none"> — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of materials |
| D. Perform manual machining operations, such as: <ul style="list-style-type: none"> ▪ scribing out ▪ sawing ▪ filing ▪ grinding ▪ sharpening ▪ drilling ▪ boring ▪ counterboring ▪ tapping ▪ threading ▪ broaching ▪ tempering ▪ removing screws and taps ▪ installing helicoils ▪ installing E-Zlock threaded parts ▪ correcting threads ▪ straightening a shaft | <ul style="list-style-type: none"> — Observance of manual machining techniques — Observance of drawings, sketches and instructions — Observance of dimensions |
| E. Check the quality of the work. | <ul style="list-style-type: none"> — Thorough and accurate verification of compliance |
| F. Tidy up the work area. | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate information related to manual machining operations in a drawing.
2. Be familiar with manual machining processes.

Before learning how to do calculations related to manual machining operations (B):

3. Be familiar with the formulas used in machining: RPM, feed, thread blank diameter, etc.

Before learning how to prepare the work area:

■ **select the tools, accessories and devices**

■ **select the materials (C):**

4. List the tools, accessories and devices needed to perform manual machining operations.
5. Distinguish among the different types of materials used to machine parts and describe their characteristics.

Before learning how to perform manual machining operations, such as scribing out, sawing, filing, grinding, sharpening, drilling, boring, counterboring, tapping, threading, broaching, tempering, removing screws and taps, installing helicoils, installing E-Zlock threaded parts, correcting threads, straightening a shaft (D):

6. Explain how to use the tools, accessories and devices needed to perform manual machining operations.
7. Explain manual machining techniques.
8. Explain the health and safety measures to adopt.

Before learning how to check the quality of the work (E):

9. Explain the different methods of checking manual machining jobs.
10. Be familiar with the standards and tolerances applicable to manual machining.

MODULE 7: PERFORMING LUBRICATION OPERATIONS

Code: 898 262

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform lubrication operations** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - instructions
 - lubrication records
 - maintenance manuals
 - ISO standards
- Using:
 - speed reduction units, variable-speed drives, compressors, machine tools, pumps, hydraulic systems, industrial machinery, etc.
 - liquid and nonliquid lubricants
 - static and dynamic seals
 - manual, semiautomatic and automatic tools
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories and devices
- Consistently careful and precise work
- Concern for total quality
- Compliance with instructions

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| <p>A. Interpret the instructions.</p> | <p>— Accurate interpretation of instructions and lubrication records</p> |
| <p>B. Prepare the work area:</p> <ul style="list-style-type: none"> ■ select the tools, accessories and devices ■ select the necessary lubricants | <p>— Appropriate selection of all the tools, accessories and devices needed for lubrication</p> <p>— Appropriate selection of lubricants</p> |
| <p>C. Perform lubrication operations, such as:</p> <ul style="list-style-type: none"> ■ handling lubricants ■ removing used liquid and nonliquid lubricants ■ disposing of waste lubricants ■ adding liquid and nonliquid lubricants ■ monitoring levels ■ ensuring that the system is leakproof ■ replacing static and dynamic seals | <p>— Observance of techniques for handling lubricants</p> <p>— Observance of techniques for adding and removing lubricants</p> <p>— Observance of techniques for installing and removing static and dynamic seals</p> <p>— Observance of manufacturer's specifications</p> |
| <p>D. Check the quality of the lubricants:</p> <ul style="list-style-type: none"> ■ check the colour, odour and texture ■ check the effectiveness of the filters | <p>— Proper verification of colour, odour and texture of the lubricants</p> <p>— Proper use of methods of checking the effectiveness of the filters</p> |
| <p>E. Maintain, repair and adjust the accessories and components of the different lubrication systems using manual, semiautomatic and automatic tools:</p> <ul style="list-style-type: none"> ■ check the accessories and components ■ check the adjustment of the lubrication systems ■ replace defective components | <p>— Observance of manufacturer's specifications</p> <p>— Accurate adjustments</p> <p>— Observance of process of replacing components</p> |
| <p>F. Tidy up the work area.</p> | <p>— Storage of tools and equipment</p> <p>— Cleanliness of work area</p> |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate information related to lubrication in the work sheets.

Before learning how to prepare the work area:

- **select the tools, accessories and devices**
- **select the necessary lubricants (B):**

2. List the tools, accessories and devices needed to perform lubrication operations.
3. Be familiar with the different types of lubricants and their uses.

Before learning how to perform lubrication operations, such as:

- **handling lubricants**
- **removing used liquid and nonliquid lubricants**
- **disposing of waste lubricants**
- **adding liquid and nonliquid lubricants**
- **monitoring levels**
- **ensuring that the system is leakproof**
- **replacing static and dynamic seals (C):**

4. Explain the methods of handling, adding and removing lubricants.
5. Explain how to use the tools, accessories and devices needed to perform lubrication operations.
6. Explain the technique for installing and removing static and dynamic seals.
7. Distinguish among the different methods of monitoring levels of lubricants.
8. Explain the health and safety measures to adopt.

Before learning how to check the quality of the lubricants:

- **check the colour, odour and texture**
- **check the effectiveness of the filters (D):**

9. Distinguish among the different colours, odours and textures of lubricants.
10. Be familiar with the methods of checking the effectiveness of filters.

SECOND-LEVEL OPERATIONAL OBJECTIVES (*cont.*)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to maintain, repair and adjust the accessories and components of the different lubrication systems using manual, semiautomatic and automatic tools:

- **check the accessories and components**
- **check the adjustment of the lubrication systems**
- **replace defective components (E):**
 11. Describe the accessories and components of the different systems.
 12. Describe the methods of adjusting and replacing components.
 13. Distinguish among the different maintenance techniques for the different systems.

MODULE 8: USING LIFTING AND HANDLING TECHNIQUES

Code: 898 272

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use lifting and handling techniques** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- With the help of a classmate
- Given:
 - lifting and handling instructions
 - crane operator's manuals
 - charts and tables
- Using:
 - parts, shop machinery or industrial equipment, such as machine tools, compressors, conveyors, drums and speed reduction units
 - tools and equipment, such as simple levers, fork lifts, hoists, cranes, cables and slings
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with standards
- Observance of signalling code in effect
- Proper use of tools, accessories, devices and measuring instruments

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the instructions.
- B. Determine the centre of gravity and weight of loads (in imperial and metric units).

SPECIFIC PERFORMANCE CRITERIA

- Accurate interpretation of instructions
- Accurate determination

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| <p>C. Plan the work:</p> <ul style="list-style-type: none">■ select the lifting and handling tools and equipment■ inspect the tools and equipment■ plan the moves | <ul style="list-style-type: none">— Appropriate selection of suspension elements and accessories in accordance with their lifting capacity and resistance to friction— Appropriate selection of lifting devices in accordance with their lifting capacity— Thorough inspection of tools and equipment— Thorough planning of moves to reduce the number of lateral movements to a minimum |
| <p>D. Perform lifting and handling operations:</p> <ul style="list-style-type: none">■ sling and rig loads■ move loads■ set down loads | <ul style="list-style-type: none">— Observance of signalling code— Observance of tie-down techniques— Observance of established plan— Loads set down at the proper locations |
| <p>E. Put away the tools and equipment.</p> | <ul style="list-style-type: none">— Inspection of tools and equipment before putting them away— Observance of storage methods |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Define lifting and handling.
2. Locate information related to the lifting and handling of equipment in the manufacturers' manuals.

Before learning how to determine the centre of gravity and weight of loads (in imperial and metric units) (B):

3. Know how to measure the different parameters in imperial and metric units.
4. Be familiar with the mathematical formulas used to calculate volume and weight.

Before learning how to plan the work:

- **select the lifting and handling tools and equipment**
- **inspect the tools and equipment**
- **plan the moves (C):**

5. Describe lifting and handling tools and equipment.
6. Be familiar with the methods of inspecting tools and equipment.
7. Be familiar with the method of planning moves.
8. Learn about the characteristics of the work sites and environmental constraints.
9. Show concern for the risks inherent in moving bulky loads.

Before learning how to perform lifting and handling operations:

- **sling and rig loads**
- **move loads**
- **set down loads (D):**

10. Be familiar with the different types of knots and how to tie them.
11. Be familiar with the load factors of the lifting equipment.
12. Define the safety factor in lifting and handling.
13. Tie the different types of knots.
14. Be familiar with the method of using suspension elements and accessories and lifting devices.
15. Distinguish among the different hand signalling codes.
16. Explain the methods of moving loads on a horizontal plane and on an inclined plane.
17. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES *(cont.)*

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to put away the tools and equipment (E):

18. Be familiar with the methods of storing tools and equipment.
19. Show concern for the cleanliness and neatness of the work area and the factors that contribute to the deterioration of equipment.

MODULE 9: PERFORMING OPERATIONS RELATED TO THE REMOVAL, INSTALLATION AND ADJUSTMENT OF SHAFTS, BEARINGS AND BUSHINGS

Code: 898 283

Duration: 45 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE**

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform operations related to the removal, installation and adjustment of shafts, bearings and bushings** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Given:
 - instructions or work orders
 - real or simulated mechanical problems
- Using:
 - operational assemblies (assembly bench)
 - mechanical equipment
 - shafts, bearings and bushings
 - specialized tools, accessories and devices
 - measuring instruments
 - safety equipment
 - reference manuals

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of shafts, bearings and bushings
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| A. Interpret the instructions. | <ul style="list-style-type: none"> — Accurate interpretation of instructions — Relevant information located in the technical manuals |
| B. Calculate the allowances and adjustments of a system involving shafts, bearings and bushings. | <ul style="list-style-type: none"> — Precise calculations |
| C. Prepare the work area: <ul style="list-style-type: none"> ■ select the tools, accessories and devices ■ select the shafts, bearings and bushings | <ul style="list-style-type: none"> — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of shafts, bearings and bushings |
| D. Remove shafts, bearings and bushings for inspection purposes. | <ul style="list-style-type: none"> — Accurate assessment of the condition of the components |
| E. Assemble and adjust shafts, bearings and bushings. | <ul style="list-style-type: none"> — Compliance with assembly instructions — Observance of tolerances and allowances — Proper lubrication of components — Shafts, bearings and bushings properly positioned |
| F. Check the quality of the work. | <ul style="list-style-type: none"> — Proper verification of operation of shafts, bearings and bushings |
| G. Fill out the work order. | <ul style="list-style-type: none"> — Accurate information — Clarity and neatness of work order |
| H. Tidy up the work area. | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate information related to shafts, bearings and bushings in the work orders.

Before learning how to calculate the allowances and adjustments of a system involving shafts, bearings and bushings (B):

2. Know how to locate the values in manufacturers' and technical manuals.
3. Understand the concepts of tolerance and adjustment.
4. Know how to use the appropriate measuring instruments.

Before learning how to prepare the work area:

■ **select the tools, accessories and devices**

■ **select the shafts, bearings and bushings (C):**

5. Be familiar with the different types of shafts, bearings and bushings, as well as their functions, characteristics and operation, and replacement products.
6. List the tools, accessories and devices needed to remove shafts, bearings and bushings.

Before learning how to remove shafts, bearings and bushings for inspection purposes (D):

7. Explain how to use the tools, accessories and devices needed to remove shafts, bearings and bushings.
8. Explain how to use the appropriate measuring instruments.
9. Explain the techniques for removing shafts, bearings and bushings.
10. Describe the different methods of inspecting shafts, bearings and bushings.

Before learning how to assemble and adjust shafts, bearings and bushings (E):

11. Explain the techniques for assembling shafts, bearings and bushings.
12. Explain how to straighten shafts.

SECOND-LEVEL OPERATIONAL OBJECTIVES (*cont.*)

IN ORDER TO ATTAIN THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to check the quality of the work (F):

13. Explain the different methods of verifying the assembly of shafts, bearings and bushings.
14. Be familiar with the applicable standards and tolerances.

MODULE 10: MAINTAINING AND REPAIRING TRANSMISSION AND MOTION TRANSFORMATION COMPONENTS AND DEVICES

Code: 898 297

Duration: 105 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE**

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **maintain and repair transmission and motion transformation components and devices**

in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - mechanical failures
 - mechanical drawings
 - specifications
 - tables and charts
 - work orders
 - technical manuals
- Using:
 - an assembly bench containing transmission and motion transformation components and devices, such as transmission belts and pulleys; conveyor rollers, drums and belts; chain wheels and drive chains; sprockets and gears; cams and eccentric rollers; speed reduction units and variable speed drives; gear boxes; clutches; brakes; couplings and universal joints
 - measuring instruments
 - tools, accessories and devices
 - lifting and handling equipment
 - safety equipment

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of systems containing transmission and motion transformation components and devices
- Careful work
- Consistently neat work
- Concern for total quality

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

A. Learn what needs to be done.

B. Calculate the parameters of a system containing transmission and motion transformation components and devices.

C. Plan the work:

- determine the sequence of operations
- select the tools, accessories and devices
- select the components
- prepare the work area

D. Handle parts and equipment.

SPECIFIC PERFORMANCE CRITERIA

— Accurate interpretation of instructions in work order

— Accurate interpretation of drawing, specifications, tables and charts

— Relevant information located in technical manuals

— Accurate calculation of power, adjustments, volume and angular and linear speed

— Accurate determination of sequence of operations

— Appropriate selection of all the necessary tools, accessories and devices

— Appropriate selection of components

— Proper preparation of work area

— Accurate determination of centre of gravity and weight of loads to be moved

— Proper use of tools and devices

— Observance of signalling code

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|---|
| <p>E. Maintain systems containing transmission and motion transformation components and devices:</p> <ul style="list-style-type: none"> ▪ check the operating parameters ▪ check the alignment ▪ clean and lubricate the components | <ul style="list-style-type: none"> — Observance of manufacturer’s specifications — Thorough verification of operating parameters — Accurate verification of alignment — Proper cleaning and lubrication of components |
| <p>F. Repair systems containing transmission and motion transformation components and devices:</p> <ul style="list-style-type: none"> ▪ remove the components ▪ sketch the components ▪ locate the source of the failure ▪ do the repair ▪ reinstall the components | <ul style="list-style-type: none"> — Proper application of removal techniques — Thorough inspection of components — Accurate measurements — Accurate sketches of the arrangement of the components — Accurate diagnosis of malfunction — Observance of reinstallation sequence — Reinstallation of components in the appropriate locations — Observance of the manual machining techniques needed to replace the components — Proper cleaning and lubrication of parts |
| <p>G. Check the operation of systems containing transmission and motion transformation components and devices.</p> | <ul style="list-style-type: none"> — Thorough verification of operating conditions |
| <p>H. Fill out the work order.</p> | <ul style="list-style-type: none"> — Accurate information — Clarity and neatness of work order |
| <p>I. Tidy up the work area.</p> | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Distinguish among the different transmission and motion transformation components and devices in the drawings.
2. Interpret drawings, specifications and work orders.
3. Know how to consult technical documentation in English and French.

Before learning how to calculate the parameters of a system containing transmission and motion transformation components and devices (B):

4. Understand how systems containing transmission and motion transformation components and devices work.
5. Be familiar with the mathematical formulas for calculating power, adjustments, volume and angular and linear speed.

Before learning how to plan the work:

- **determine the sequence of operations**
- **select the tools, accessories and devices**
- **select the components**
- **prepare the work area (C):**

6. Explain the process of maintaining and repairing transmission and motion transformation components and devices.
7. List the tools, accessories and devices needed to repair and maintain transmission and motion transformation components and devices.
8. Distinguish among the different transmission and motion transformation components and devices.

Before learning how to handle parts and equipment (D):

9. Describe how to use lifting and handling equipment and accessories.
10. Understand the methods of calculating the centre of gravity and weight of loads.
11. Interpret the signals used in handling.
12. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES (*cont.*)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to maintain and repair systems containing transmission and motion transformation components and devices:

- **check the operating parameters**
- **check the alignment**
- **clean and lubricate the components**
- **remove the components**
- **sketch the components**
- **locate the source of the failure**
- **do the repair**
- **reinstall the components (E) and (F):**
 13. Explain the operating principles of transmission and motion transformation components and devices.
 14. Describe the techniques for maintaining and repairing transmission and motion transformation components and devices.
 15. Use measuring instruments.
 16. Sketch parts.
 17. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in transmission and motion transformation components and devices.
 18. Explain the method of cleaning transmission and motion transformation components and devices.
 19. Explain how to use the tools, accessories and devices needed to maintain and repair transmission and motion transformation components and devices.
 20. Be familiar with the methods of diagnosing malfunctions in transmission and motion transformation components and devices.
 21. Manually machine parts.
 22. Explain the health and safety measures to adopt.

Before learning how to check the operation of systems containing transmission and motion transformation components and devices (G):

23. Explain the different methods of checking the operation of transmission and motion transformation components and devices.
24. Be familiar with the applicable standards and tolerances.

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to fill out the work order (H):

25. Describe the parts of a work order.
26. Show concern for the accuracy of the information provided.

MODULE 11: WORKING WITH TUBES, PIPES AND HOSES

Code: 898 303

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **work with tubes, pipes and hoses** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Given:
 - piping installation drawings or sketches
 - specifications
 - reference manuals
 - charts
- Using:
 - regular and specialized tools
 - steel hydraulic tubes
 - copper, steel and ABS pipes
 - rubber hydraulic hoses
 - measuring instruments
 - a central compressed air or water supply

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories and devices
- Careful work
- Consistently neat work
- Concern for total quality
- Concern for price-quality ratio

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| A. Interpret the instructions. | <ul style="list-style-type: none"> — Accurate interpretation of drawings and specifications — Relevant information located in charts and reference manuals |
| B. Prepare the work area: <ul style="list-style-type: none"> ■ select the tools, accessories and devices ■ select the ducts, fittings, attachments and sealing materials | <ul style="list-style-type: none"> — Appropriate selection of all the tools, accessories and devices — Appropriate selection of pipes, tubes, hoses, fittings and sealing materials |
| C. Do the work preparatory to assembling tubes, pipes and hoses, such as: <ul style="list-style-type: none"> ■ measuring ■ cutting ■ bending ■ flaring ■ tinning ■ threading ■ gluing ■ attaching ■ crimping | <ul style="list-style-type: none"> — Observance of methods, techniques and dimensions |
| D. Fit and assemble functional circuits. | <ul style="list-style-type: none"> — Observance of drawings and specifications — Observance of fitting and assembling techniques — Perfect leaktightness of assembly |
| E. Check the quality of the assembly. | <ul style="list-style-type: none"> — Proper application of leak tests — Thorough verification of the dimensions, arrangement and attachment of components |
| F. Tidy up the work area. | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate information related to the assembly of piping components in the drawings and specifications.
2. Be familiar with basic plumbing standards.

Before learning how to prepare the work area:

- **select the tools, accessories and devices**
- **select the ducts, fittings, attachments and sealing materials (B):**
 3. Distinguish among the different types of tubes, pipes, hoses and valves.
 4. Distinguish among the colour codes for the different types of ducts.
 5. List the tools, accessories and devices needed to assemble piping components.

Before learning how to do the work preparatory to assembling tubes, pipes and hoses, such as:

- **measuring**
- **cutting**
- **bending**
- **flaring**
- **tinning**
- **threading**
- **gluing**
- **attaching**
- **crimping (C):**
 6. Explain how to use the tools, accessories and devices needed to assemble piping components.
 7. Explain the health and safety measures to adopt.

Before learning how to fit and assemble functional circuits (D):

8. Describe the methods of assembling and fitting the different types of functional circuits.
9. Explain the process.

Before learning how to check the quality of the assembly (E):

10. Be familiar with the methods of checking the leaktightness of circuits.
11. Be familiar with the applicable standards and tolerances.

MODULE 12: USING ALIGNMENT TECHNIQUES

Code: 898 314

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use alignment techniques** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Given:
 - reference manuals
 - drawings and specifications
 - mathematical formulas
- Using:
 - an assembly bench
 - operational machinery and equipment
 - a ruler and callipers
 - dial gauges
 - laser devices
 - optical alignment instruments
 - measuring instruments
 - specialized tools
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Careful work
- Consistently neat work
- Observance of tolerances

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|---|
| A. Interpret the instructions. | — Accurate interpretation of information related to the alignment in the drawings, specifications and reference manuals |
| B. Select the tools, accessories and devices. | — Appropriate selection of all the tools, accessories and devices |
| C. Inspect the components, the machines and the foot adjustment. | <ul style="list-style-type: none"> — Appropriate and thorough inspection of components and machines — Appropriate correction of foot adjustment, if necessary |
| D. Do calculations related to the alignment. | — Precise calculations |
| E. Align machines. | <ul style="list-style-type: none"> — Use of specialized devices in compliance with instructions — Observance of tolerances |
| F. Insert shims under the support points. | — Proper installation of shims at the appropriate locations |
| G. Check the quality of the work. | — Thorough verification of the quality of the alignment |
| H. Tidy up the work area. | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate information related to the alignment in the drawings, specifications and manufacturers' manuals.

Before learning how to select the tools, accessories and devices (B):

2. List the tools, accessories and devices needed to do an alignment.

Before learning how to inspect the components, the machines and the foot adjustment (C):

3. Determine the radial and axial play of a shaft.
4. Define the concentricity of a shaft and a coupling with the axis of the machine.
5. Check the quality of the bases of the machines to be aligned.
6. Distinguish among the different types of foot adjustments.

Before learning how to do calculations related to the alignment (D):

7. Be familiar with the formulas for correcting the foot adjustment.

Before learning how to align machines (E):

8. Explain how to use the tools, accessories and devices needed to align the machines (ruler and callipers, dial gauge, optical level and laser device).

Before learning how to insert shims under the support points (F):

9. Distinguish among the different types of shims.
10. Explain how to use shims.

Before learning how to check the quality of the work (G):

11. Explain the methods of checking the alignment.
12. Be familiar with the applicable standards and tolerances.

MODULE 13: MAINTAINING AND REPAIRING INDUSTRIAL PUMPS AND MOTORS

Code: 898 325

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **maintain and repair industrial pumps and motors** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - industrial pump and motor failures
 - drawings
 - specifications
 - work orders
 - technical manuals
- Using:
 - positive and nonpositive displacement pumps and hydraulic motors
 - piping components
 - measuring instruments
 - tools, accessories and devices
 - lifting and handling equipment
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of industrial pumps and motors
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| A. Learn what needs to be done. | <ul style="list-style-type: none"> — Accurate interpretation of instructions in work order — Accurate interpretation of drawing and specifications — Relevant information located in technical manuals |
| B. Calculate the operating parameters of industrial pumps and motors. | <ul style="list-style-type: none"> — Accurate calculation of pressure, flow, speed, power and volume |
| C. Plan the work: <ul style="list-style-type: none"> ■ determine the sequence of operations ■ select the tools, accessories and devices ■ select the parts ■ prepare the work area | <ul style="list-style-type: none"> — Accurate determination of sequence of operations — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of replacement parts — Proper preparation of work area |
| D. Handle parts and equipment. | <ul style="list-style-type: none"> — Accurate determination of centre of gravity and weight of loads to be moved — Proper use of tools and devices — Observance of signalling code |
| E. Maintain industrial pumps and motors: <ul style="list-style-type: none"> ■ check the operating parameters ■ check the alignment ■ clean and lubricate the components | <ul style="list-style-type: none"> — Observance of manufacturer's specifications — Thorough verification of operating parameters — Proper verification of alignment — Proper cleaning and lubrication of components |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| F. Repair industrial pumps and motors: <ul style="list-style-type: none">■ disassemble the parts■ sketch the parts■ locate the source of the failure■ do the repair■ reassemble the parts | <ul style="list-style-type: none">— Proper application of removal techniques— Thorough inspection of components— Accurate measurements— Accurate sketches of the arrangement of the parts of the motor and pump— Accurate diagnosis of malfunction— Observance of repair techniques— Observance of reassembly sequence— Parts repositioned at the appropriate locations— Precise alignment of parts and mechanisms— Observance of the manual machining techniques needed to repair the parts— Observance of techniques for assembling and fitting piping components— Proper cleaning and lubrication of parts |
| G. Check the operation of industrial pumps and motors. | <ul style="list-style-type: none">— Thorough verification of operating conditions |
| H. Fill out the work order. | <ul style="list-style-type: none">— Accurate information— Clarity and neatness of work order |
| I. Tidy up the work area. | <ul style="list-style-type: none">— Storage of tools and equipment— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Distinguish among the different types of industrial pumps and motors.
2. Interpret drawings, specifications and work orders.
3. Know how to consult technical documentation in English and French.

Before learning how to calculate the operating parameters of industrial pumps and motors (B):

4. Explain the basic principles of mechanics.
5. Be familiar with the mathematical formulas for calculating pressure, flow, speed, power and volume.

Before learning how to plan the work:

- **determine the sequence of operations**
- **select the tools, accessories and devices**
- **select the parts**
- **prepare the work area (C):**

6. Explain the process of assembling, maintaining and repairing industrial pumps and motors.
7. List the tools, accessories and devices needed to repair and maintain industrial pumps and motors.
8. Describe the components of industrial pumps and motors.

Before learning how to handle parts and equipment (D):

9. Describe how to use lifting and handling equipment and accessories.
10. Understand the methods of calculating the centre of gravity and weight of loads.
11. Interpret the signals used in handling.
12. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES (*cont.*)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to maintain and repair industrial pumps and motors:

- **check the operating parameters**
- **check the alignment**
- **clean and lubricate the components**
- **disassemble the parts**
- **sketch the parts**
- **locate the source of the failure**
- **do the repair**
- **reassemble the parts (E) and (F):**
 13. Explain the operating principles of industrial pumps and motors.
 14. Describe the techniques for assembling, maintaining and repairing industrial pumps and motors.
 15. Use measuring instruments.
 16. Align components, elements and parts.
 17. Sketch parts.
 18. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in industrial pumps and motors.
 19. Explain the method of cleaning industrial pumps and motors.
 20. Explain how to use the tools, accessories and devices needed to maintain and repair industrial pumps and motors.
 21. Be familiar with the methods of diagnosing malfunctions in industrial pumps and motors.
 22. Manually machine parts.
 23. Assemble and fit piping components.
 24. Explain the health and safety measures to adopt.

Before learning how to check the operation of industrial pumps and motors (G):

25. Explain the different methods of checking the operation of industrial pumps and motors.
26. Be familiar with the applicable standards and tolerances.

MODULE 14: CHECKING THE ELECTRICAL COMPONENTS OF INDUSTRIAL PRODUCTION EQUIPMENT

Code: 898 336

Duration: 90 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **check the electrical components of industrial production equipment** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - a real or simulated malfunction
 - electrical circuit diagrams
 - specifications
- Using:
 - specialized tools, accessories, devices and measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Observance of electrical code
- Observance of current legislation respecting occupational qualifications
- Proper use of tools, accessories, devices and measuring instruments
- Careful work
- Concern for total quality

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

- A. Interpret the electrical circuit and equipment diagrams.
- B. Calculate the parameters of an electrical circuit.

SPECIFIC PERFORMANCE CRITERIA

- Proper use of the appropriate formulas
- Precise calculations
- Proper use of the appropriate formulas
- Precise calculations

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| C. Measure the values at different points in the circuit: <ul style="list-style-type: none">• amperage• voltage• resistance | <ul style="list-style-type: none">— Systematic observance of safety measures— Appropriate selection of measuring instruments— Proper use of measuring instruments— Accurate connections— Accurate measurements |
| D. Interpret the results. | <ul style="list-style-type: none">— Accurate interpretation of calculations— Accurate interpretation of measurements— Accurate calculation of deviations— Accurate determination of the causes of the deviations |
| E. Convey information about the condition of the electrical circuit. | <ul style="list-style-type: none">— Accurate recording of defects encountered— Detailed and objective presentation of results |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the electrical circuit and equipment diagrams (A):

1. Be familiar with the symbols used in electricity.
2. Be familiar with the rules for drawing diagrams of electrical circuits.

Before learning how to calculate the parameters of an electrical circuit (B):

3. Explain the basic principles of electricity.
4. Differentiate between alternating and direct current.

Before learning how to measure the values at different points in the circuit:

- **amperage**
- **voltage**
- **resistance (C):**

5. Be familiar with Ohm's Law.
6. Explain how to use measuring instruments in electricity.

Before learning how to interpret the results (D):

7. Distinguish among the different types of diagrams used in electricity.
8. Explain the role of the electrical components in an electrical circuit (power, control).
9. Explain how an electric motor control circuit works.
10. Explain the methods of checking electrical components.
11. Explain the methods of checking the operating parameters of industrial equipment.
12. Interpret the data sheets for the electrical components.

Before learning how to convey information about the condition of the electrical circuit (E):

13. Synthesize information.
14. Explain the causes of the deviations.

**MODULE 15: MAINTAINING, REPAIRING AND ADJUSTING VACUUM PUMPS,
PNEUMATIC MOTORS AND COMPRESSORS**

Code: 898 345

Duration: 75 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **maintain, repair and adjust vacuum pumps, pneumatic motors and compressors** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - vacuum pump, pneumatic motor and compressor failures
 - drawings
 - specifications
 - work orders
 - technical manuals
- Using:
 - vacuum pumps, pneumatic motors and positive displacement compressors
 - piping components
 - measuring instruments
 - tools, accessories and devices
 - lifting and handling equipment
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of vacuum pumps, pneumatic motors and compressors
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| A. Learn what needs to be done. | <ul style="list-style-type: none"> — Accurate interpretation of instructions in work order — Accurate interpretation of drawing and specifications — Relevant information located in technical manuals |
| B. Calculate the operating parameters of vacuum pumps, pneumatic motors and compressors. | <ul style="list-style-type: none"> — Accurate calculation of pressure, flow, speed, power and volume |
| C. Plan the work: <ul style="list-style-type: none"> ■ determine the sequence of operations ■ select the tools, accessories and devices ■ select the parts ■ prepare the work area | <ul style="list-style-type: none"> — Accurate determination of sequence of operations — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of replacement parts — Proper preparation of work area |
| D. Handle parts and equipment. | <ul style="list-style-type: none"> — Accurate determination of centre of gravity and weight of loads to be moved — Proper use of tools and devices — Observance of signalling code |
| E. Maintain vacuum pumps, pneumatic motors and compressors: <ul style="list-style-type: none"> ■ check the operating parameters ■ check the alignment ■ clean and lubricate the components | <ul style="list-style-type: none"> — Observance of manufacturer's specifications — Thorough verification of operating parameters — Accurate verification of alignment — Proper cleaning and lubrication of components |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| <p>F. Repair vacuum pumps, pneumatic motors and compressors:</p> <ul style="list-style-type: none"> ▪ remove the components ▪ sketch the components ▪ locate the source of the failure ▪ do the repair ▪ reinstall the components | <ul style="list-style-type: none"> — Proper application of removal techniques — Thorough inspection of components — Accurate measurements — Accurate sketches of the arrangement of the components — Accurate diagnosis of malfunction — Observance of repair techniques — Observance of reinstallation sequence — Reinstallation of components in the appropriate locations — Accurate alignment of components — Observance of the manual machining techniques needed to repair the components — Observance of techniques for assembling and fitting piping components — Proper cleaning and lubrication of parts |
| <p>G. Measure and adjust the operating parameters of vacuum pumps, pneumatic motors and compressors.</p> | <ul style="list-style-type: none"> — Accurate measurements — Adjustments in compliance with specifications |
| <p>H. Check the operation of vacuum pumps, pneumatic motors and compressors.</p> | <ul style="list-style-type: none"> — Thorough verification of operating conditions |
| <p>I. Fill out the work order.</p> | <ul style="list-style-type: none"> — Accurate information — Clarity and neatness of work order |
| <p>J. Tidy up the work area.</p> | <ul style="list-style-type: none"> — Appropriate storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Distinguish among the different types of vacuum pumps, pneumatic motors and compressors.
2. Interpret drawings, specifications, work orders and electrical circuit diagrams.
3. Know how to consult technical documentation in English and French.

Before learning how to calculate the operating parameters of vacuum pumps, pneumatic motors and compressors (B):

4. Explain the basic principles governing pneumatics.
5. Be familiar with the formulas for calculating pressure, flow, speed, power and volume.

Before learning how to plan the work:

- **determine the sequence of operations**
- **select the tools, accessories and devices**
- **select the parts**
- **prepare the work area (C):**

6. Explain the process of assembling, maintaining and repairing vacuum pumps, pneumatic motors and compressors.
7. List the tools, accessories and devices needed to repair and maintain vacuum pumps, pneumatic motors and compressors.
8. Describe the components of vacuum pumps, pneumatic motors and compressors.

Before learning how to handle parts and equipment (D):

9. Describe how to use lifting and handling equipment and accessories.
10. Understand the methods of calculating the centre of gravity and weight of loads.
11. Interpret the signals used in handling.
12. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES (cont.)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to maintain and repair vacuum pumps, pneumatic motors and compressors:

- **check the operating parameters**
- **check the alignment**
- **clean and lubricate the components**
- **remove the components**
- **sketch the components**
- **locate the source of the failure**
- **do the repair**
- **reinstall the components (E) and (F):**
 13. Explain the operating principles of vacuum pumps, pneumatic motors and compressors.
 14. Describe the techniques for assembling, maintaining and repairing vacuum pumps, pneumatic motors and compressors.
 15. Use measuring instruments.
 16. Align components, elements and parts.
 17. Sketch parts.
 18. Interpret electrical circuits.
 19. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in vacuum pumps, pneumatic motors and compressors.
 20. Explain the method of cleaning vacuum pumps, pneumatic motors and compressors.
 21. Explain how to use the tools, accessories and devices needed to maintain and repair vacuum pumps, pneumatic motors and compressors.
 22. Be familiar with the methods of diagnosing malfunctions in vacuum pumps, pneumatic motors and compressors.
 23. Manually machine parts.
 24. Assemble and fit piping components.
 25. Explain the health and safety measures to adopt.

Before learning how to measure and adjust the operating parameters of vacuum pumps, pneumatic motors and compressors (G):

26. Use measuring instruments.
27. Describe the techniques for adjusting the operating parameters of vacuum pumps, pneumatic motors and compressors.
28. Show concern for obtaining precise measurements and adjustments.

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to check the operation of vacuum pumps, pneumatic motors and compressors (H):

29. Explain the different methods of checking the operation of vacuum pumps, pneumatic motors and compressors.
30. Be familiar with the applicable standards and tolerances.

MODULE 16: ASSEMBLING, MAINTAINING AND REPAIRING HYDRAULIC AND ELECTROHYDRAULIC CIRCUITS

Code: 898 358

Duration: 120 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **assemble, maintain and repair hydraulic and electrohydraulic circuits** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - hydraulic and electrohydraulic failures
 - hydraulic and electrohydraulic circuit diagrams
 - technical documentation
 - work orders
- Using:
 - electrohydraulic equipment
 - electrohydraulic equipment with proportional hydraulic systems
 - specialized tools, accessories and devices
 - measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of equipment
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| A. Learn what needs to be done. | <ul style="list-style-type: none"> — Accurate interpretation of instructions in work order — Accurate interpretation of circuit diagrams |
| B. Calculate the parameters of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems. | <ul style="list-style-type: none"> — Accurate calculation of pressure, flow, speed, power and volume |
| C. Plan the work: <ul style="list-style-type: none"> ■ determine the sequence of operations ■ select the tools, accessories and devices ■ select the components, fittings and ducts ■ prepare the work area | <ul style="list-style-type: none"> — Accurate determination of sequence of operations — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of all the components, fittings and ducts — Proper preparation of work area |
| D. Assemble hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems. | <ul style="list-style-type: none"> — Observance of circuit diagram — Observance of techniques for assembling components, fittings and ducts — Perfectly leaktight assembly |
| E. Maintain hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems: <ul style="list-style-type: none"> ■ check the components ■ clean and lubricate the components | <ul style="list-style-type: none"> — Observance of manufacturer's specifications — Thorough verification of components — Proper cleaning and lubrication of components |
| F. Repair hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems: <ul style="list-style-type: none"> ■ locate the source of the failure ■ repair or replace the components | <ul style="list-style-type: none"> — Accurate determination of source of failure — Observance of techniques for repairing or replacing components — Observance of techniques for assembling and fitting ducts and fittings — Proper cleaning and lubrication of components |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| G. Measure and adjust the operating parameters of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems. | — Accurate measurements
— Adjustments in compliance with specifications |
| H. Check the operation of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems. | — Thorough verification of operating conditions of circuits |
| I. Fill out the work order. | — Accurate information
— Clarity and neatness of work order |
| J. Tidy up the work area. | — Appropriate storage of tools and equipment
— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Be familiar with the symbols used in hydraulics and electrohydraulics, as well as the rules for drawing diagrams of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
2. Locate instructions related to hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems, in the specifications and work orders.
3. Interpret electrical circuit diagrams.

Before learning how to calculate the parameters of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems (B):

4. Explain the laws governing hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
5. Be familiar with the formulas used to calculate the pressure, flow, speed, power and volume of a hydraulic circuit.

Before learning how to plan the work:

- **determine the sequence of operations**
- **select the tools, accessories and devices**
- **select the components, fittings and ducts**
- **prepare the work area (C):**

6. Explain the process of assembling, maintaining and repairing hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
7. List the tools, accessories and devices needed to assemble, maintain and repair hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
8. Describe the components, fittings and ducts used in hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.

SECOND-LEVEL OPERATIONAL OBJECTIVES (cont.)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to assemble, maintain and repair hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems:

- **check the components**
- **clean and lubricate the components**
- **locate the source of the failure**
- **repair or replace the components (D), (E) and (F):**
 9. Explain the operating principles of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 10. Describe the techniques for assembling, maintaining and repairing hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 11. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 12. Explain the method of cleaning hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 13. Explain how to use the tools, accessories and devices needed to assemble, maintain and repair hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 14. Be familiar with the methods of diagnosing malfunctions in hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
 15. Assemble and fit piping components.
 16. Explain the health and safety measures to adopt.

Before learning how to measure and adjust the operating parameters of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems (G):

17. Use measuring instruments.
18. Describe the techniques for adjusting the operating parameters of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
19. Show concern for obtaining precise measurements and adjustments.

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to check the operation of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems (H):

20. Explain the different methods of checking the operation of hydraulic and electrohydraulic circuits, and electrohydraulic circuits with proportional hydraulic systems.
21. Be familiar with the applicable standards and tolerances.

MODULE 17: ASSEMBLING, MAINTAINING AND REPAIRING PNEUMATIC AND ELECTROPNEUMATIC CIRCUITS

Code: 898 365

Duration: 75 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **assemble, maintain and repair pneumatic and electropneumatic circuits** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - pneumatic and electropneumatic failures
 - electropneumatic circuit diagrams
 - specifications
 - work orders
- Using:
 - electropneumatic equipment
 - specialized tools, accessories and devices
 - measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of pneumatic and electropneumatic circuits
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Learn what needs to be done.	<ul style="list-style-type: none"> — Accurate interpretation of instructions in work order — Accurate interpretation of circuit diagrams
B. Calculate the parameters of a pneumatic circuit.	<ul style="list-style-type: none"> — Accurate calculation of pressure, flow, speed, power and volume
C. Plan the work: <ul style="list-style-type: none"> ■ determine the sequence of operations ■ select the tools, accessories and devices ■ select the components, fittings and ducts ■ prepare the work area 	<ul style="list-style-type: none"> — Accurate determination of sequence of operations — Appropriate selection of all the necessary tools, accessories and devices — Appropriate selection of all the components, fittings and ducts — Proper preparation of work area
D. Assemble pneumatic and electropneumatic circuits.	<ul style="list-style-type: none"> — Observance of circuit diagram — Observance of techniques for assembling components, fittings and ducts — Perfectly leaktight assembly
E. Maintain pneumatic and electropneumatic circuits: <ul style="list-style-type: none"> ■ check the components ■ clean and lubricate the components 	<ul style="list-style-type: none"> — Observance of manufacturer's specifications — Thorough verification of components — Proper cleaning and lubrication of components
F. Repair pneumatic and electropneumatic circuits: <ul style="list-style-type: none"> ■ locate the source of the failure ■ repair or replace the components 	<ul style="list-style-type: none"> — Accurate determination of source of failure — Observance of techniques for repairing or replacing components — Observance of techniques for assembling and fitting ducts and fittings — Proper cleaning and lubrication of components
G. Measure and adjust the operating parameters of pneumatic and electropneumatic circuits.	<ul style="list-style-type: none"> — Accurate measurements — Adjustments in compliance with specifications
H. Check the operation of pneumatic and electropneumatic circuits.	<ul style="list-style-type: none"> — Thorough verification of operating conditions of circuits

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

I. Fill out the work order.

- Accurate information
- Clarity and neatness of work order

J. Tidy up the work area.

- Appropriate storage of tools and equipment
- Cleanliness of work area

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Be familiar with the symbols used in pneumatics and electropneumatics, as well as the rules for drawing pneumatic and electropneumatic circuit diagrams.
2. Locate instructions related to pneumatic and electropneumatic circuits in the specifications and work orders.
3. Interpret electrical circuit diagrams.

Before learning how to calculate the parameters of a pneumatic circuit (B):

4. Explain the laws governing fluids.
5. Be familiar with formulas used to calculate the pressure, flow, speed, power and volume of a pneumatic circuit.

Before learning how to plan the work:

- **determine the sequence of operations**
- **select the tools, accessories and devices**
- **select the components, fittings and ducts**
- **prepare the work area (C):**

6. Explain the process of assembling, maintaining and repairing pneumatic and electropneumatic circuits.
7. List the tools, accessories and devices needed to assemble, maintain and repair pneumatic and electropneumatic circuits.
8. Describe the components, fittings and ducts used in pneumatic and electropneumatic circuits.

SECOND-LEVEL OPERATIONAL OBJECTIVES (cont.)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to assemble, maintain and repair pneumatic and electropneumatic circuits:

- **check the components**
- **clean and lubricate the components**
- **locate the source of the failure**
- **repair or replace the components (D), (E) and (F):**
 9. Explain the operating principles of pneumatic and electropneumatic circuits.
 10. Describe the techniques for assembling, maintaining and repairing pneumatic and electropneumatic circuits.
 11. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in pneumatic and electropneumatic circuits.
 12. Explain the method of cleaning pneumatic and electropneumatic components.
 13. Explain how to use the tools, accessories and devices needed to assemble, maintain and repair pneumatic and electropneumatic circuits.
 14. Be familiar with the methods of diagnosing malfunctions in pneumatic and electropneumatic circuits.
 15. Assemble and fit piping components.
 16. Explain the health and safety measures to adopt.

Before learning how to measure and adjust the operating parameters of pneumatic and electropneumatic circuits (G):

17. Use measuring instruments.
18. Describe the techniques for adjusting the operating parameters of pneumatic and electropneumatic circuits.
19. Show concern for obtaining precise measurements and adjustments.

Before learning how to check the operation of pneumatic and electropneumatic circuits (H):

20. Explain the different methods of checking the operation of pneumatic and electropneumatic circuits.
21. Be familiar with the applicable standards and tolerances.

MODULE 18: USING STATIC AND DYNAMIC BALANCING TECHNIQUES

Code: 898 373

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use static and dynamic balancing techniques** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Given:
 - verbal instructions or work orders
 - tables and charts
 - reference manuals
- Using:
 - machinery, equipment or an operational assembly
 - a balancing stand
 - balancing equipment
 - a computer and balancing software
 - specialized tools, accessories and devices
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories and devices
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| A. Interpret the instructions. | — Accurate interpretation of instructions or work order
— Accurate interpretation of tables and charts |
| B. Do calculations related to balancing: <ul style="list-style-type: none">■ RPM■ mass of rotor■ balancing mass | — Precise calculations |
| C. Select the tools, accessories and devices. | — Appropriate selection of all the necessary tools, accessories and devices |
| D. Balance a piece of industrial equipment on one and two planes, using the following static and dynamic balancing techniques: <ul style="list-style-type: none">■ between bearings■ overhung■ adding weights■ removing weights■ splitting weights■ combining weights■ changing the correction radius■ without phase measurement | — Observance of balancing process
— Accurate balancing |
| E. Balance different pieces of equipment on a balancing stand, using static and dynamic balancing techniques. | — Observance of balancing process
— Accurate balancing |
| F. Tidy up the work area. | — Storage of tools and equipment
— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Understand the information related to balancing in the tables and charts.

Before learning how to do calculations related to balancing:

- **RPM**
- **mass of rotor**
- **balancing mass (B):**
 2. Be familiar with the formulas related to ratios, speed and volume.
 3. Know how to use the tables to determine the weight of materials.

Before learning how to select the tools, accessories and devices (C):

4. List the tools, accessories and devices needed to use static and dynamic balancing techniques.

Before learning how to balance a piece of industrial equipment on one and two planes, using the following static and dynamic balancing techniques:

- **between bearings**
- **overhung**
- **adding weights**
- **removing weights**
- **splitting weights**
- **combining weights**
- **changing the correction radius**
- **without phase measurement (D):**
 5. Describe how to use the tools, accessories and devices needed to use static and dynamic balancing techniques.
 6. Know how to use balancing software.
 7. Explain the different techniques for balancing on one and two planes.
 8. Explain the health and safety measures to adopt.

Before learning how to balance different pieces of equipment on a balancing stand, using static and dynamic balancing techniques (E):

9. Describe how to use a balancing stand.
10. Explain the different static and dynamic balancing techniques using a balancing stand.
11. Explain the health and safety measures to adopt.

MODULE 19: USING LOGICAL DIAGNOSTIC PROCEDURES

Code: 898 384

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use logical diagnostic procedures** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - pneumatic, electropneumatic, hydraulic, electrohydraulic, mechanical, electromechanical and electrical failures
 - diagrams of industrial machinery
 - technical documentation
- Using:
 - pneumatic, electropneumatic, hydraulic, electrohydraulic, mechanical, electromechanical and electrical equipment
 - problem-solving methods
 - specialized tools, accessories and devices
 - a computer and software
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of problem-solving method
- Proper use of tools, accessories, devices and measuring instruments
- Accurate diagnosis
- Concern for total quality

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Interpret the diagrams and specifications.

SPECIFIC PERFORMANCE CRITERIA

— Accurate interpretation

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| B. Break down industrial equipment into systems and subsystems. | — Accurate breakdown into systems and subsystems |
| C. Define the operating conditions of the systems and subsystems. | — Accurate definition |
| D. Diagnose malfunctions in pneumatic, electropneumatic, hydraulic, electrohydraulic, mechanical, electromechanical and electrical equipment. | — Accurate diagnosis |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the diagrams and specifications (A):

1. Be familiar with the rules for drawing diagrams of pneumatic, electropneumatic, hydraulic, electrohydraulic, mechanical, electromechanical and electrical circuits.
2. Locate information in specifications.

Before learning how to break down industrial equipment into systems and subsystems (B):

3. Describe the sequential cycles in basic automation.
4. Understand the operating conditions of combination systems.
5. Be capable of applying a systemic approach.

Before learning how to define the operating conditions of the systems and subsystems (C):

6. Be familiar with the cascade method (electrical, pneumatic, electropneumatic and electrohydraulic).
7. Be familiar with the GRAFCET method.

Before learning how to diagnose malfunctions in pneumatic, electropneumatic, hydraulic, electrohydraulic, mechanical, electromechanical and electrical equipment (D):

8. Be capable of breaking down industrial systems.
9. Be capable of defining the operating conditions.
10. Be capable of applying the cascade and GRAFCET methods.

MODULE 20: TROUBLESHOOTING AUTOMATED SYSTEMS

Code: 898 396

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **troubleshoot automated systems** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - mechanical, electromechanical, pneumatic, electropneumatic, hydraulic and electrohydraulic failures
 - ladder diagram or GRAFCET programs
 - programming software
 - technical documentation
 - work orders
- Using:
 - automated electromechanical, electropneumatic and electrohydraulic systems
 - components or elements of disassembled, out-of-adjustment or defective systems
 - specialized tools, accessories and devices
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of automated systems
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| A. Read the work order and the technical documentation. | — Accurate interpretation of work order
— Accurate interpretation of technical documentation |
| B. Diagnose the malfunctions in the automated system. | — Accurate interpretation of information provided by the automaton
— Accurate interpretation of information provided by the programming software
— Accurate identification of defective components
— Proper application of logical diagnostic procedures |
| C. Correct automated system failures. | — Thorough planning
— Appropriate selection of all the necessary tools, accessories and devices
— Observance of techniques for installing and adjusting new components |
| D. Check the operation of the automated system. | — Thorough verification of operating conditions of system |
| E. Fill out the work order. | — Accurate information
— Clarity and neatness of work order |
| F. Tidy up the work area. | — Appropriate storage of tools and equipment
— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to read the work order and the technical documentation (A):

1. Distinguish among the different types of automated systems (mechanical, electropneumatic and electrohydraulic).
2. Interpret drawings, specifications, work orders and electrical circuit diagrams.
3. Know how to use a manufacturer's maintenance manual.

Before learning how to diagnose the malfunctions in the automated system (B):

4. Distinguish among the different components of an automaton and describe their characteristics.
5. Explain the operating procedure of the automated system.
6. Be familiar with the syntax used in the programming software.
7. Be familiar with the programming software used.
8. Explain the methods of diagnosing malfunctions.
9. Explain the health and safety measures to adopt.

Before learning how to correct automated system failures (C):

10. Explain the process of troubleshooting automated systems.
11. List the tools, accessories and devices needed to troubleshoot automated systems.
12. Describe the techniques for installing and adjusting the components of an automated system.

Before learning how to check the operation of the automated system (D):

13. Explain the different methods of checking the operation of pneumatic and electropneumatic circuits.
14. Be familiar with the applicable standards and tolerances.

MODULE 21: USING VIBRATION ANALYSIS TECHNIQUES

Code: 898 403

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **use vibration analysis techniques** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - verbal instructions or work orders
 - tables and charts
 - drawings of machinery or equipment
- Using:
 - operational machinery, equipment or assemblies
 - specialized tools, accessories and devices
 - a vibration analyzer
 - a computer and vibration analysis software
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories and devices
- Careful work
- Consistently neat work
- Concern for total quality

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Interpret the instructions.

SPECIFIC PERFORMANCE CRITERIA

— Accurate interpretation of instructions and drawings

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|---|
| B. Select the tools, devices and accessories. | — Appropriate selection of all the tools, devices and accessories |
| C. Use a vibration analyzer in data collection mode: <ul style="list-style-type: none">▪ transfer a vibration route from the computer to the vibration analyzer▪ read the vibration data using the analyzer▪ transfer the data collected from the analyzer to the computer▪ print the necessary reports | — Proper use of computer and analyzer
— Observance of technique for taking readings and transferring data
— Appropriate selection of reports to be printed |
| D. Interpret the data collected. | — Proper use of vibration analysis software
— Observance of analysis process
— Proper use of tables and charts
— Accurate identification of equipment malfunctions |
| E. Clean and store the equipment used. | — Proper cleaning and storage of equipment |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate the instructions related to vibration analysis in a work order.

Before learning how to select the tools, devices and accessories (B):

2. List the tools, devices and accessories needed for vibration analysis.

Before learning how to use a vibration analyzer in data collection mode:

- **transfer a vibration route from the computer to the vibration analyzer**
- **read the vibration data using the analyzer**
- **transfer the data collected from the analyzer to the computer**
- **print the necessary reports (C):**
 3. Describe how to use the tools, devices and accessories needed for vibration analysis.
 4. Be familiar with the characteristics of vibrations.
 5. Be familiar with the functions of the vibration analysis software.
 6. Be familiar with the operation of the vibration analyzer in data collection mode.
 7. Explain the technique for taking vibration readings.
 8. Describe the possible ways of positioning and pointing the sensor when taking measurements.

Before learning how to interpret the data collected (D):

9. Be familiar with the causes of vibrations.
10. Recognize the data in the verification tables.
11. Be familiar with the functions of the vibration analysis software.
12. Explain the information provided by a vibrational spectrum (nature and origin of equipment malfunctions).
13. Describe the positioning of the sensors and the photocell in relation to the diagnosis to be made.
14. Explain the adjustment of the analyzer for taking readings.
15. Recognize the data in the tables and charts used for verification.

MODULE 22: PERFORMING MACHINING OPERATIONS USING MACHINE TOOLS

Code: 898 416

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform machining operations using machine tools** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - instructions or work orders
 - drawings and sketches
 - charts or tables
 - reference manuals
- Using:
 - ferrous and nonferrous materials
 - nonmetal materials (neoprene, plastic, etc.)
 - industrial equipment
 - tools, accessories and devices
 - measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Consistently careful and precise work
- Concern for total quality
- Concern for price-quality ratio

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| A. Interpret the instructions. | — Accurate interpretation of instructions
— Accurate interpretation of information related to machining in drawings, sketches, tables and charts |
| B. Do calculations related to machining operations using machine tools. | — Precise calculations |
| C. Prepare the work area: <ul style="list-style-type: none">▪ select the tools, accessories and devices▪ select the materials | — Appropriate selection of all the necessary tools, accessories and devices
— Appropriate selection of materials |
| D. Perform machining operations using machine tools, such as: <ul style="list-style-type: none">▪ sawing▪ drilling▪ turning▪ countersinking▪ grinding▪ plating | — Observance of techniques for machining using machine tools
— Compliance of operations with drawings, sketches and instructions
— Observance of dimensions |
| E. Check the quality of the work. | — Thorough and accurate verification of the compliance of the work |
| F. Tidy up the work area. | — Storage of tools and equipment
— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the instructions (A):

1. Locate in a drawing the information related to machining using machine tools.
2. Be familiar with machining processes using machine tools.

Before learning how to do calculations related to machining operations using machine tools (B):

3. Be familiar with the mathematical formulas needed to perform machining operations, such as those related to RPM, feed and thread blank diameter.

Before learning how to prepare the work area:

- **select the tools, accessories and devices**
- **select the materials (C):**

4. List the tools, accessories, devices and equipment needed to perform machining operations using machine tools.
5. Distinguish among the different types of materials used to machine parts using machine tools and describe their characteristics.

Before learning how to perform machining operations using machine tools, such as:

- **sawing**
- **drilling**
- **turning**
- **countersinking**
- **grinding**
- **plating (D):**

6. Explain how to use the tools, accessories and devices needed to perform machining operations using machine tools.
7. Explain the techniques for performing machining operations using machine tools.
8. Explain the health and safety measures to adopt.

Before learning how to check the quality of the work (E):

9. Explain the different methods of checking machining operations performed using machine tools.
10. Be familiar with the standards and tolerances applicable to the performance of machining operations using machine tools.

MODULE 23: PERFORMING CUTTING AND WELDING OPERATIONS

Code: 898 428

Duration: 120 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform cutting and welding operations** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - assembly drawings
 - data sheets
- Using:
 - semiautomatic welding equipment
 - 4-in. or 100-mm pipes
 - plates and bars
 - tools, accessories and devices
 - measuring instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of technique
- Observance of requirements
- Proper use of tools, accessories, devices and measuring instruments
- Consistently careful and precise work
- Quality of welds and cuts

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Interpret the drawings and data sheets.

SPECIFIC PERFORMANCE CRITERIA

- Accurate interpretation of drawing
- Accurate interpretation of instructions in data sheets

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| <p>B. Prepare the work area:</p> <ul style="list-style-type: none"> ▪ select the tools, accessories, devices and equipment ▪ assemble the cutting and welding setups | <ul style="list-style-type: none"> — Appropriate selection of all the tools, accessories, devices and equipment needed — Proper assembly of cutting and welding setups |
| <p>C. Cut plates, bars and tubes using oxyacetylene and plasma arc cutting techniques.</p> | <ul style="list-style-type: none"> — Observance of prescribed dimensions and angles — Proper cleaning of cuts |
| <p>D. Arc weld mild steel, stainless steel, cast iron and aluminum plates and angle irons in the horizontal and vertical positions.</p> | <ul style="list-style-type: none"> — Proper adjustment of welding parameters — Uniform weld bead — Observance of welding process — Observance of prescribed welding position — Proper cleaning of welds |
| <p>E. Assemble plates, pipes and bars using semiautomatic welding techniques.</p> | <ul style="list-style-type: none"> — Proper adjustment of welding parameters — Accurate location and sequence of tacking — Proper positioning of assembled parts — Observance of assembly angles and dimensions — Observance of welding procedure — Proper cleaning of welds |
| <p>F. Check the quality of the work.</p> | <ul style="list-style-type: none"> — Thorough verification of angles and dimensions — Accurate identification of welding defects, if applicable — Accurate determination of corrective measures |
| <p>G. Tidy up the work area.</p> | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the drawings and data sheets (A):

1. List the characteristics of an assembly drawing and a data sheet.
2. Be familiar with the symbols used in welding.

Before learning how to prepare the work area:

■ **select the tools, accessories, devices and equipment**

■ **assemble the cutting and welding setups (B):**

3. Distinguish among the different welding processes.
4. Be familiar with the criteria for selecting welding rods, electrodes and solder.
5. Distinguish among the different tools, accessories and devices needed for electric arc and semiautomatic welding and for oxyacetylene and plasma arc cutting.
6. Distinguish among ferrous and nonferrous materials.

Before learning how to cut plates, bars and tubes using oxyacetylene and plasma arc cutting techniques (C):

7. Be familiar with oxyacetylene and plasma arc cutting equipment.
8. Explain the oxyacetylene and plasma arc cutting techniques.
9. Be familiar with the quality criteria for cuts.
10. Explain the health and safety measures to adopt.

Before learning how to arc weld mild steel, stainless steel, cast iron and aluminum plates and angle irons in the horizontal and vertical positions and to assemble plates, pipes and bars using semiautomatic welding techniques (D) and (E):

11. Explain the techniques for producing a penetration bead using the arc welding process.
12. Explain the semiautomatic welding techniques and the techniques for assembling plates, pipes and bars.
13. Describe the factors to be controlled during welding.
14. Be familiar with the qualities of a good weld.
15. Show concern for achieving the proper tacking sequence.

Before learning how to check the quality of the work (F):

16. Be familiar with arc welding and semiautomatic welding standards.
17. Be familiar with the tolerances applicable to the evaluation of welds.
18. Describe the causes of welding defects and determine the appropriate corrective measures.

MODULE 24: PERFORMING METAL FORMING OPERATIONS

Code: 898 432

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform metal forming operations** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - detail drawings of a part
 - parallel line development, radial line development and triangulation
 - reference manuals
- Using:
 - sheet metal (maximum 26-gauge)
 - cutting, bending and assembling tools and equipment
 - measuring and marking-out instruments
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Observance of requirements
- Proper use of tools, accessories, devices and measuring instruments
- Consistently careful and precise work
- Quality of metal forming

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Interpret the drawing.

SPECIFIC PERFORMANCE CRITERIA

— Accurate interpretation of drawing

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| B. Prepare the work area: <ul style="list-style-type: none">▪ determine the amount of material needed▪ select the tools, accessories and devices | <ul style="list-style-type: none">— Accurate determination of amount of material needed for the job— Appropriate choice of all the tools, accessories and devices needed for the marking-out and forming operations |
| C. Perform marking-out and development operations. | <ul style="list-style-type: none">— Observance of marking-out and development techniques |
| D. Perform metal forming operations, such as: <ul style="list-style-type: none">▪ cutting▪ bending▪ riveting and resistance welding | <ul style="list-style-type: none">— Observance of drawing— Observance of cutting, bending and assembly techniques— Precise, neat work |
| E. Tidy up the work area. | <ul style="list-style-type: none">— Storage of tools and equipment— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to interpret the drawing (A):

1. Distinguish the information in a drawing related to the development of parts.
2. Be familiar with dimensioning methods.

Before learning how to prepare the work area:

■ **determine the amount of material needed**

■ **select the tools, accessories and devices (B):**

3. Explain the methods of calculating surfaces and volumes.
4. Describe how to use the different tools, accessories and devices needed to perform marking-out and metal forming operations.

Before learning how to perform marking-out and development operations (C):

5. Explain the methods of marking out and developing parts.
6. Be familiar with the rules of parallelism and triangulation (marking out).
7. Be familiar with the rules of projection (transfer of dimensions).

Before learning how to perform metal forming operations, such as:

■ **cutting**

■ **bending**

■ **riveting and resistance welding (D):**

8. Describe how to use cutting, bending and metal forming equipment.
9. Explain the methods of adjusting the equipment.
10. Explain the methods of riveting and resistance welding.
11. Be familiar with established quality standards.
12. Explain the health and safety measures to adopt.

MODULE 25: APPLYING A PREVENTIVE AND PROSPECTIVE MAINTENANCE PROGRAM FOR INDUSTRIAL EQUIPMENT

Code: 898 444

Duration: 60 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **apply a preventive and prospective maintenance program for industrial equipment** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - work orders generated by a maintenance software program
 - drawings and diagrams
 - manufacturers' maintenance manuals
 - mechanical, pneumatic, hydraulic and electrical failures
- Using:
 - operational industrial equipment including mechanical, pneumatic, hydraulic and electrical systems
 - a maintenance software program
 - specialized tools, accessories and devices
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of industrial equipment
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| <p>A. Learn what needs to be done.</p> | <ul style="list-style-type: none"> — Proper use of maintenance software program to generate the work order — Accurate interpretation of instructions in work order — Accurate interpretation of drawing and diagram — Relevant information located in the manufacturer's maintenance manual |
| <p>B. Plan the work:</p> <ul style="list-style-type: none"> ■ determine the steps in the maintenance routine ■ select the tools, accessories and devices ■ prepare the work area | <ul style="list-style-type: none"> — Accurate determination of the steps in the maintenance routine — Appropriate selection of all the tools, accessories and devices needed for troubleshooting — Proper preparation of work area |
| <p>C. Perform preventive and prospective maintenance operations on equipment.</p> | <ul style="list-style-type: none"> — Observance of specifications and instructions — Observance of component assembly, disassembly, reassembly and adjustment techniques — Reinstallation of components in the appropriate locations — Accurate measurements — Accurate alignment of components — Observance of static and dynamic balancing techniques — Observance of the manual machining techniques needed to repair components — Observance of piping component assembly and fitting techniques — Observance of cutting, welding and metal forming techniques — Observance of techniques for lifting and handling parts and equipment — Proper cleaning and lubrication of parts |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|---|
| <p>D. Participate in a work group discussion to find ways of optimizing the operation of the equipment in terms of:</p> <ul style="list-style-type: none"> ▪ the nature and frequency of inspections ▪ parts replacement ▪ equipment modifications ▪ etc. | <ul style="list-style-type: none"> — Clear explanations of the proposed solutions — Observance of communication techniques — Demonstration of attitudes and behaviours conducive to discussion |
| <p>E. Check the operation of the equipment.</p> | <ul style="list-style-type: none"> — Thorough verification of operating conditions of system — Proper application of the appropriate vibration analysis techniques |
| <p>F. Fill out the work order.</p> | <ul style="list-style-type: none"> — Accurate information — Clarity and neatness of work order |
| <p>G. Tidy up the work area.</p> | <ul style="list-style-type: none"> — Storage of tools and equipment — Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Know how to use a maintenance software program and a computer in order to generate preventive and prospective maintenance work orders.
2. Understand the application of preventive and prospective maintenance programs.
3. Interpret drawings, specifications, work orders and electrical circuit diagrams.
4. Know how to use technical documentation in English and French.

Before learning how to plan the work:

- **determine the steps in the maintenance routine**
- **select the tools, accessories and devices**
- **prepare the work area (B):**

5. Explain the process related to the preventive and prospective maintenance of industrial equipment.
6. List the tools, accessories and devices needed to troubleshoot industrial equipment.

Before learning how to perform preventive and prospective maintenance operations on equipment (C):

7. Explain the operating principles of a piece of industrial equipment.
8. List the tools, accessories and devices needed to perform preventive and prospective maintenance operations.
9. Describe the techniques for disassembling, reassembling and adjusting industrial equipment components.
10. Use measuring instruments.
11. Align components, elements and parts.
12. Interpret electrical circuits.
13. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in industrial equipment.
14. Explain the method of cleaning industrial equipment.
15. Explain how to use the tools, accessories and devices needed to troubleshoot industrial equipment.
16. Manually machine parts.
17. Assemble and fit piping components.
18. Use static and dynamic balancing techniques.
19. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES (*cont.*)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to participate in a work group discussion to find ways of optimizing the operation of the equipment in terms of:

- **the nature and frequency of inspections**
- **parts replacement**
- **equipment modifications**
- **etc. (D):**

20. Explain the methods of participating in work groups or quality circles in industry.
21. Be familiar with the techniques for communicating in a work group.
22. Show concern for the quality of communication.

Before learning how to check the operation of the equipment (E):

23. Explain the methods of checking the operating parameters of industrial equipment.
24. Be familiar with established standards and tolerances.
25. Use vibration analysis techniques.

MODULE 26: USING JOB SEARCH TECHNIQUES

Code: 898 451

Duration: 15 hours

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE****EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **use job search techniques** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Given:
 - real or potential jobs in industrial construction and maintenance mechanics
 - learning situations
- Using the appropriate documentation

GENERAL PERFORMANCE CRITERIA

- Observance of standards for the presentation of written documents
- Realistic job search in accordance with the requirements of the workplace
- Quality of oral and written communication

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

- A. Write their résumé.
- B. Write a letter of application.
- C. Undergo a simulated job interview.

SPECIFIC PERFORMANCE CRITERIA

- Relevant information
- Clarity and neatness of text
- Correct spelling and grammar

- Letter relevant to the job applied for
- Observance of the rules for presenting a letter of application

- Observance of the rules of presentation and behaviour in an interview
- Relevant responses

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to write their résumé (A):

1. Define the role and advantages of a résumé.
2. Indicate the qualities of a good résumé.
3. List their qualities and achievements.

Before learning how to write a letter of application (B):

4. Explain the rules for writing a letter of application.
5. Indicate the qualities of a good letter of application.

Before learning how to undergo a simulated job interview (C):

6. Understand the importance of being well prepared for an interview.
7. Do research on the company.
8. Analyze the selection criteria for the position to be filled.
9. Distinguish among the rules of presentation and behaviour in a job interview.

MODULE 27: INSTALLING INDUSTRIAL EQUIPMENT

Code: 898 466

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **install industrial equipment** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working in pairs
- Given:
 - installation specifications
 - manufacturers' manuals
- Using:
 - industrial equipment components
 - specialized tools, accessories and devices
 - lifting and handling equipment
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of techniques
- Compliance with installation standards
- Proper use of tools, accessories, devices and measuring instruments
- Optimal operation of equipment
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| <p>A. Learn what needs to be done.</p> | <ul style="list-style-type: none"> — Accurate interpretation of instructions in work order — Accurate interpretation of drawing and installation specifications — Relevant information located in the manufacturer's manual |
| <p>B. Plan the installation:</p> <ul style="list-style-type: none"> ▪ consult the installation parameters ▪ inventory the components and elements to be installed ▪ sketch the installation ▪ determine the sequence of operations ▪ select the tools, accessories and devices | <ul style="list-style-type: none"> — Accurate and thorough inventory of components and elements to be installed — Accurate determination of sequence of operations — Appropriate choice of all the tools, accessories and devices needed for the installation |
| <p>C. Prepare the work area:</p> <ul style="list-style-type: none"> ▪ clean the area ▪ determine the availability of power sources ▪ position the anchors, spread the grout mixture and install the ground plates | <ul style="list-style-type: none"> — Proper cleaning of area — Thorough verification of the power sources needed for the installation — Appropriate positioning of anchors and ground plates — Observance of techniques for spreading grout mixture and installing ground plates |
| <p>D. Handle the equipment components.</p> | <ul style="list-style-type: none"> — Accurate determination of centre of gravity and weight of components to be moved — Proper use of tools and devices — Observance of signalling code |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|--|
| E. Install the equipment. | <ul style="list-style-type: none">— Observance of installation specifications— Observance of techniques for installing components— Appropriate positioning of equipment components— Accurate alignment of components— Observance of static and dynamic balancing techniques— Observance of the manual machining techniques and machining techniques using machine tools needed to install the components— Observance of piping component assembly and fitting techniques— Observance of cutting, welding and metal forming techniques, if applicable— Proper cleaning and lubrication of parts |
| F. Perform startup operations. | <ul style="list-style-type: none">— Observance of equipment startup procedure |
| G. Check the operation of the equipment. | <ul style="list-style-type: none">— Thorough verification of operating conditions of system— Use and accuracy of information provided |
| H. Fill out the work order. | <ul style="list-style-type: none">— Accurate information— Clarity and neatness of work order |
| I. Tidy up the work area. | <ul style="list-style-type: none">— Storage of tools and equipment— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to learn what needs to be done (A):

1. Interpret an industrial equipment installation drawing.

Before learning how to plan the installation:

- **consult the installation parameters**
- **inventory the components and elements to be installed**
- **sketch the installation**
- **determine the sequence of operations**
- **select the tools, accessories and devices (B):**
 2. Describe the different types of industrial equipment components and elements.
 3. Sketch parts.
 4. Explain the process of installing industrial equipment components and elements.
 5. List the tools, accessories and devices needed to install industrial equipment.

Before learning how to prepare the work area:

- **clean the area**
- **determine the availability of power sources**
- **position the anchors, spread the grout mixture and install the ground plates (C):**
 6. Show concern for the cleanliness of the area.
 7. Locate the power sources and determine their capacity.
 8. Be familiar with the techniques for checking power sources.
 9. Explain the techniques for installing anchors and ground plates and spreading grout mixture.
 10. Explain the levelling techniques.
 11. Use measuring instruments.
 12. Explain the health and safety measures to adopt.

Before learning how to handle the equipment components (D):

13. Use lifting and handling techniques.
14. Explain the logistics of handling as it relates to the installation of industrial equipment.
15. Explain the health and safety measures to adopt.

SECOND-LEVEL OPERATIONAL OBJECTIVES (cont.)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to install the equipment (E):

16. Explain the process of installing industrial equipment.
17. List the tools, accessories and devices needed to install industrial equipment.
18. Describe the techniques for installing industrial equipment components.
19. Use measuring instruments.
20. Align components, elements and parts.
21. Interpret electrical circuits.
22. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in the installation of industrial equipment.
23. Explain the method of cleaning industrial equipment.
24. Explain how to use the tools, accessories and devices needed to install industrial equipment.
25. Machine parts manually and using machine tools.
26. Assemble and fit piping components.
27. Use static and dynamic balancing techniques.
28. Perform cutting, welding and metal forming operations.
29. Explain the health and safety measures to adopt.

Before learning how to perform startup operations (F):

30. Explain the method of connecting motors clockwise and counterclockwise.

Before learning how to check the operation of the equipment (G):

31. Explain the different methods of checking the operation of industrial equipment.
32. Use vibration analysis techniques.
33. Be familiar with the applicable standards and tolerances.

MODULE 28: TROUBLESHOOTING INDUSTRIAL EQUIPMENT

Code: 898 475

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **troubleshoot industrial equipment** in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Given:
 - mechanical, pneumatic, hydraulic and electrical failures
 - specifications
 - work orders
 - manufacturers' maintenance manuals
- Using:
 - operational industrial equipment
 - components or elements of disassembled, out-of-adjustment or defective systems
 - specialized tools, accessories and devices
 - lifting and handling equipment
 - safety equipment

GENERAL PERFORMANCE CRITERIA

- Observance of occupational health and safety rules
- Observance of work process
- Compliance with standards
- Proper use of tools, accessories, devices and measuring instruments
- Proper application of logical diagnostic procedures
- Optimal operation of industrial equipment
- Careful work
- Consistently neat work
- Concern for total quality

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|--|---|
| <p>A. Learn what needs to be done.</p> | <ul style="list-style-type: none"> — Accurate interpretation of the instructions in the work order — Accurate interpretation of drawing and specifications — Relevant information located in the manufacturer's maintenance manual |
| <p>B. Diagnose malfunctions in the equipment:</p> <ul style="list-style-type: none"> ▪ sketch the installation ▪ select the tools, accessories and devices needed for the verification ▪ check the operating parameters ▪ apply the necessary vibration analysis techniques ▪ make a list of the possible causes of the malfunction ▪ determine the cause of the malfunction | <ul style="list-style-type: none"> — Accurate sketch — Appropriate selection of all the tools, accessories and devices needed to check the operating parameters — Accurate list of all the possible causes of the malfunction — Accurate determination of the cause of the malfunction — Proper use of vibration analysis techniques |
| <p>C. Prepare the troubleshooting operation:</p> <ul style="list-style-type: none"> ▪ determine the actions to be taken ▪ select the tools, accessories and devices needed for the troubleshooting operation | <ul style="list-style-type: none"> — Accurate determination of actions to be taken — Appropriate selection of all the tools, accessories and devices needed for the troubleshooting operation |

**FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE (cont.)**

**SPECIFICATIONS OF THE
EXPECTED BEHAVIOUR**

SPECIFIC PERFORMANCE CRITERIA

- | | |
|---|--|
| D. Perform troubleshooting operations on equipment. | <ul style="list-style-type: none">— Observance of component disassembly, reassembly and adjustment techniques— Observance of troubleshooting techniques— Reinstallation of components in the appropriate locations— Accurate measurements— Accurate alignment of components— Observance of static and dynamic balancing techniques— Observance of the manual machining techniques and techniques for machining using machine tools needed to repair components— Observance of piping component assembly and fitting techniques— Observance of cutting, welding and metal forming techniques— Observance of techniques for lifting and handling parts and equipment— Proper cleaning and lubrication of parts |
| E. Check the operation of the equipment. | <ul style="list-style-type: none">— Thorough verification of operating conditions of system |
| F. Fill out the work order. | <ul style="list-style-type: none">— Accurate information— Clarity and neatness of work order |
| G. Tidy up the work area. | <ul style="list-style-type: none">— Appropriate storage of tools and equipment— Cleanliness of work area |

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to diagnose malfunctions in the equipment:

- **sketch the installation**
- **select the tools, accessories and devices needed for the verification**
- **check the operating parameters**
- **apply the necessary vibration analysis techniques**
- **make a list of the possible causes of the malfunction**
- **determine the cause of the malfunction (B):**
 1. Sketch parts.
 2. Explain the operating principles of a piece of industrial equipment.
 3. List the tools, accessories and devices needed to check the operating parameters of industrial equipment.
 4. Explain the methods of checking the operating parameters of industrial equipment.
 5. Explain the methods of diagnosing malfunctions.
 6. Be familiar with the possible causes of malfunctions in industrial equipment.
 7. Use logical diagnostic procedures to diagnose malfunctions.
 8. Use vibration analysis techniques.
 9. Explain the health and safety measures to adopt.

Before learning how to prepare the troubleshooting operation:

- **determine the actions to be taken**
- **select the tools, accessories and devices needed for the troubleshooting operation (C):**
 10. Explain the process of troubleshooting industrial equipment.
 11. Explain the nature of the different troubleshooting operations.
 12. List the tools, accessories and devices needed to troubleshoot industrial equipment.

SECOND-LEVEL OPERATIONAL OBJECTIVES (cont.)

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before learning how to perform troubleshooting operations on equipment (D):

13. List the tools, accessories and devices needed to troubleshoot industrial equipment.
14. Describe the techniques for disassembling, reassembling and adjusting industrial equipment components.
15. Describe the techniques for troubleshooting industrial equipment components.
16. Use measuring instruments.
17. Align components, elements and parts.
18. Interpret electrical circuits.
19. Perform lubrication operations and distinguish among the different types of lubricants and their method of use in industrial equipment.
20. Explain the method of cleaning industrial equipment.
21. Explain how to use the tools, accessories and devices needed to troubleshoot industrial equipment.
22. Machine parts manually and using machine tools.
23. Assemble and fit piping components.
24. Use static and dynamic balancing techniques.
25. Perform cutting, welding and metal forming operations.
26. Explain the health and safety measures to adopt.

Before learning how to check the operation of the equipment (E):

27. Explain the different methods of checking the operation of industrial equipment.
28. Be familiar with the applicable standards and tolerances.

MODULE 29: DOING A PRACTICUM IN THE WORKPLACE

Code: 898 486

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE

EXPECTED OUTCOME

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to
do a practicum in the workplace.

SPECIFICATIONS

During this module, the students will:

- Become familiar with the working conditions related to the trade.
- Integrate the knowledge, skills, attitudes and habits acquired during the program.
- Become aware of how the practicum will affect their perception of the trade.

LEARNING CONTEXT

PHASE 1: Preparing for the Practicum

- Becoming familiar with information about the practicum and the related terms and conditions.
- Listing companies likely to accept trainees.
- Learning about the physical organization of the workplace.

PHASE 2: Participating in Trade-Related Activities

- Observing the work environment: types of products manufactured and techniques used, internal structure and working conditions, occupational health and safety, interpersonal relations, etc.
- Becoming part of a work team.
- Observing or performing various trade-related tasks, or participating in their performance.
- Producing a brief report describing their observations of the work environment and of the tasks performed in the company.

**FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE (cont.)**

PHASE 3: Comparing Initial Perceptions With the Actual Work Environment

- Establishing relationships between their actions in the workplace and the knowledge acquired in the classroom.
- Discussing the accuracy of their perception of the trade before and after the practicum: workplace, occupational practices, etc.
- Discussing the effects of the practicum on their career choice: aptitudes, preferences and interests.

INSTRUCTIONAL GUIDELINES

The teacher should:

- Provide the students with the means to choose an appropriate practicum position.
- Maintain close ties between the school and the company.
- Promote the observation and performance of a variety of trade-related tasks.
- Make sure that the trainees are supervised by a responsible employee of the company.
- Ensure regular support and supervision of the students.
- Intervene if difficulties or problems arise.
- Encourage the students to engage in discussions and to express themselves.

PARTICIPATION CRITERIA

- PHASE 1:**
- Attempt to understand the practical organization of the practicum and their responsibilities.
- PHASE 2:**
- Observe the company's work schedules, policies concerning the activities they are authorized to carry out and other rules.
 - Apply the occupational health and safety rules in effect in the company.
 - Participate actively in the performance of the different trade-related tasks.
 - Ask on a regular basis for more information about the methods, techniques and tools used.
 - Attempt to produce daily reports of their observations about the tasks performed.
- PHASE 3:**
- Discuss with their classmates their experiences in the workplace.

SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

Before undertaking the activities of Phase 1 (Preparing for the Practicum):

1. Describe the steps involved in planning a practicum search.
2. Explain the importance of the practicum in the program and for the job search.
3. Describe the rules to follow in the workplace.

Before undertaking the activities of Phase 2 (Participating in Trade-Related Activities):

4. Describe the behaviour to adopt in the workplace.
5. Describe the points to record during a practicum.

Before undertaking the activities of Phase 3 (Comparing Initial Perceptions With the Actual Work Environment):

6. List their aptitudes, preferences and interests with respect to the trade.
7. Describe the requirements of the workplace.

