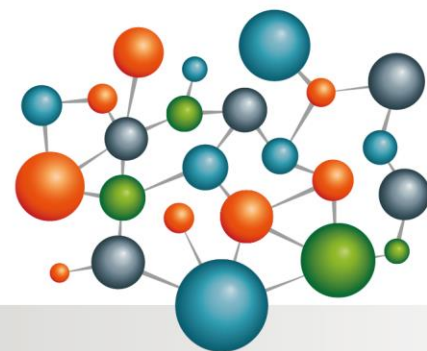


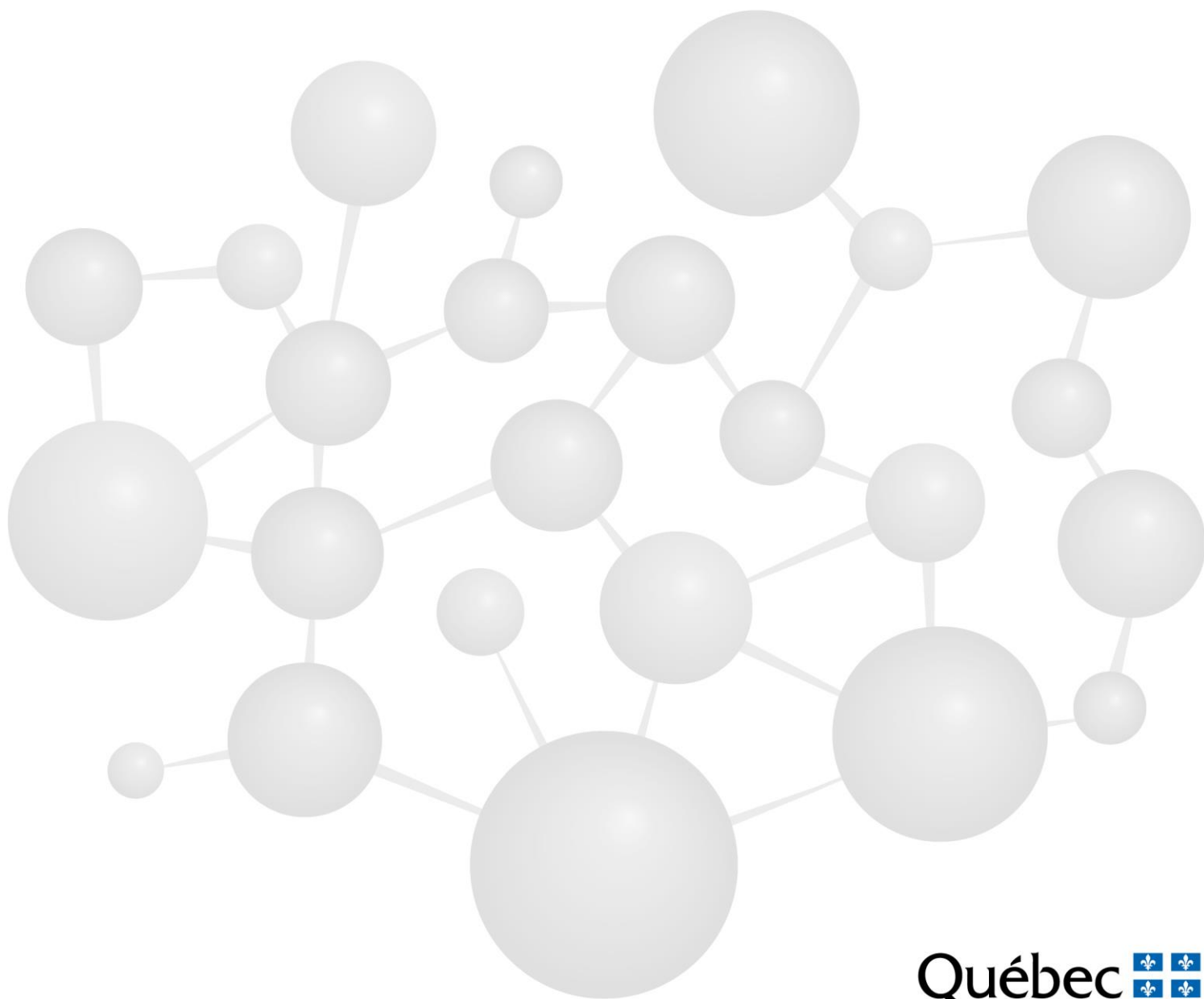
# PROGRAM OF STUDY

## HEAVY VEHICLE MECHANICS (DVS 5830)

Training sector  
MOTORIZED EQUIPMENT MAINTENANCE



MINISTÈRE DE L'ÉDUCATION



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# Introduction to the Program

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

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

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

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

## Program Components

### Program Goals

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

### Educational Aims

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

### Competency

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

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

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<sup>1</sup> *Education Act*, CQLR, c. I-13.3, s. 461

## 1. Behavioural Competency

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

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

## 2. Situational Competency

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

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

## Competency-Related Knowledge and Know-How

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



## **Duration**

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

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

## **Credit**

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

# **Aspects of Program Implementation**

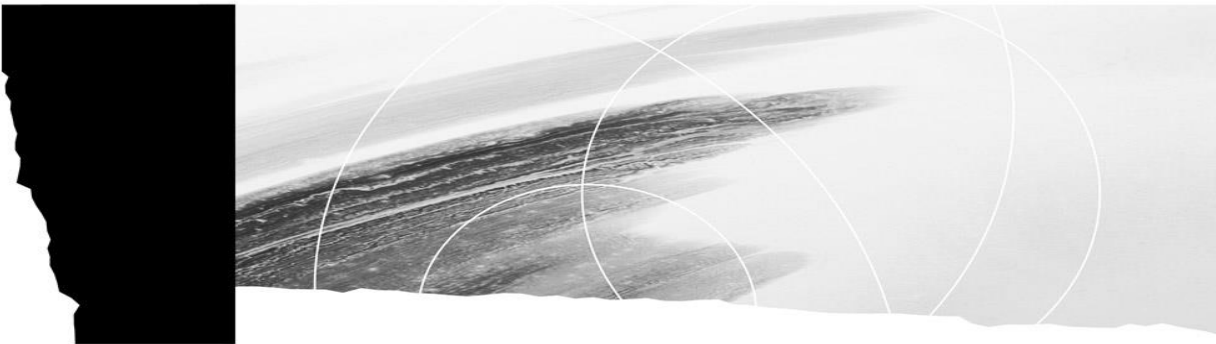
## **Program-Based Approach**

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

## **Competency-Based Approach**

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





5830

## Heavy Vehicle Mechanics

Year of approval: 2011

<b>Certification:</b>	Diploma of Vocational Studies
<b>Number of credits:</b>	120
<b>Number of competencies:</b>	24
<b>Total duration:</b>	1800 hours

To be eligible for admission to the *Heavy Vehicle Mechanics* program, candidates must meet one of the following requirements:

- Persons holding a Secondary School Diploma or its recognized equivalent.

OR

- Persons who are at least 16 years of age on September 30 of the school year in which they begin their training must meet the following condition: they must have obtained Secondary IV credits in language of instruction, second language and mathematics in programs established by the Minister, or have been granted recognition of equivalent learning.

OR

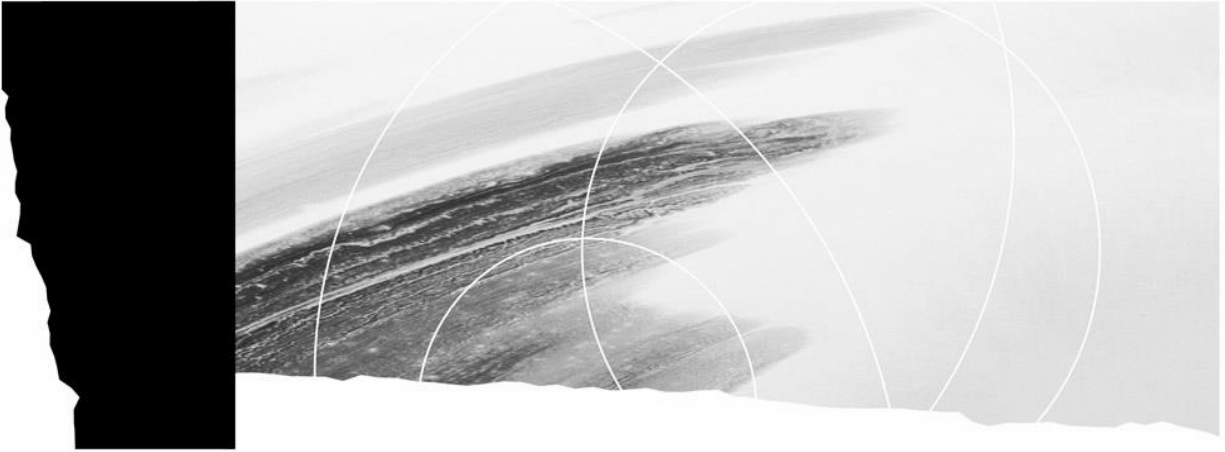
- Persons who are at least 18 years of age upon entry into the program must have the following functional prerequisites: the successful completion of the general development test and ENG-2102-4 or recognition of equivalent learning.

OR

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

The duration of the program is 1800 hours, which includes 1350 hours spent on the specific competencies required to practise the trade or occupation and 450 hours on general, work-related competencies. The program of study is divided into 24 competencies which vary in length from 15 hours to 135 hours. The total hours allocated to the program include time devoted to teaching, evaluation of learning and enrichment or remedial activities.

<b>Competency</b>	<b>Code</b>	<b>Number</b>	<b>Hours</b>	<b>Credits</b>
The Trade and the Training Process	850561	1	15	1
Health, Safety and Environmental Protection	850562	2	30	2
Retrieval of Technical Information	850563	3	45	3
Shop Work	850565	4	75	5
Heating, Welding and Cutting	850575	5	75	5
Workplace Communication	850572	6	30	2
Repair and Replacement of Wheels and Their Components	850573	7	45	3
Inspection of Hydraulic and Pneumatic Systems	850566	8	90	6
Maintenance and Repair of Suspensions, Chassis Frames and Fifth Wheels	850585	9	75	5
Inspection of Electrical and Electronic Systems	850576	10	90	6
Maintenance and Repair of Hydraulic Power Steering Systems	850595	11	75	5
Maintenance and Repair of Hydraulic and Pneumatic Braking Systems	850568	12	120	8
Repair of Transmission Systems	850578	13	120	8
Repair of Differential Systems	850564	14	60	4
Maintenance and Replacement of Automatic Transmissions	850583	15	45	3
Maintenance and Repair of Charging and Starting Systems	850574	16	60	4
Repair of Hydraulic Equipment on a Heavy Vehicle	850584	17	60	4
Repair of Cab Elements, Accessories and Circuits	850586	18	90	6
General Maintenance of Diesel Injection Systems and Engine Brakes	850567	19	105	7
Tuning of Diesel Engines	850577	20	105	7
Inspection and Replacement of Diesel Engines	850594	21	60	4
Repair of Diesel Engines	850588	22	120	8
Periodic Maintenance on a Heavy Vehicle	850605	23	75	5
Entering the Workforce	850609	24	135	9



## **Part I**

---

**Program Goals**

**Educational Aims**

**Statements of the Competencies**

**Grid of Competencies**

**Harmonization**



## Program Goals

The *Heavy Vehicle Mechanics* program prepares students to practise the trade of heavy vehicle mechanic.

Heavy vehicle mechanics are “generalists.” Their work consists in maintaining heavy vehicles to keep them in perfect running order. This ensures maximum uptime and guarantees the safety of the operator and other people on the road. To this end, heavy vehicle mechanics perform routine maintenance. They diagnose malfunctions by accurately locating the source and cause of the problem. This may include adjusting, recalibrating or replacing defective parts. They also install optional accessories and equipment. In all cases, heavy vehicle mechanics comply with occupational health and safety and environmental protection regulations.

In general, heavy vehicle mechanics work on conventional and computer-controlled vehicle components and systems such as hydraulic power steering systems, hydraulic and air brake systems, powertrain components, electrical systems, diesel injection systems, engines and brakes. They also work on wheels, suspensions, chassis frames, fifth wheels, hydraulic systems and passenger cab accessories and components.

The job of heavy vehicle mechanic has become more complex in recent years due to rapid advances in technology and the wide variety of vehicles found on the market. This ever-growing complexity requires heavy vehicle mechanics to possess advanced skill sets. They must be able to look up accurate technical information. They must refer to schematics and diagrams and follow elaborate troubleshooting or repair procedures. Effective communication skills are essential. Being able to accurately communicate with superiors, co-workers as well as with clients greatly facilitates the heavy vehicle mechanic's ability to diagnose and repair vehicles by providing them with correct information. Advanced problem-solving skills, versatility, and the ability to learn as well as the ability to work autonomously are essential.

The program goals of the *Heavy Vehicle Mechanics* program are based on the general goals of vocational training. These goals are as follows:

- To help students develop effectiveness in the practice of a trade or occupation, that is:
  - to teach students to perform roles, functions, tasks and activities associated with the trade or occupation upon entry into the job market
  - to prepare students to progress satisfactorily on the job (which implies having the technical and technological knowledge and skills in such areas as communication, problem solving, decision making, ethics, health and safety)
- To help students integrate into the workforce, that is:
  - to familiarize students with the job market in general, and with the specific context of their chosen trade or occupation
  - to familiarize students with their rights and responsibilities as workers
- To foster students' personal development and acquisition of occupational knowledge, skills, perceptions and attitudes, that is:
  - to help students develop their autonomy and ability to learn, and acquire effective work methods
  - to help students understand the principles underlying the techniques and the technology used in the trade or occupation
  - to help students develop self-expression, creativity, initiative and entrepreneurial spirit
  - to help students adopt the attitudes required to successfully practise the trade or occupation, and instill in them a sense of responsibility and a concern for excellence

- To promote job mobility, that is:
  - to help students develop positive attitudes toward change
  - to help students develop the means to manage their careers by familiarizing them with entrepreneurship

## **Educational Aims**

The aim of the *Heavy Vehicle Mechanics* program is to help students develop attitudes and behaviours that representatives from education and the field deem essential to the practice of the trade or occupation:

- Understand the importance of projecting a positive and professional image of the trade through their attitudes, appearance and language
- Understand the impact of their work on road safety and the quality of the environment
- Understand the impact of following occupational health and safety rules on their own physical and mental well-being and that of the people around them
- Develop autonomy in diagnosing and solving problems
- Develop the ability to think and to establish causal links



# Statements of the Competencies

## List of Competencies

Determine their suitability for the trade and the training process.  
Prevent risks with regard to occupational health and safety, and the environment.  
Find technical information about heavy vehicles.  
Do shop work.  
Perform heating, welding and cutting tasks.  
Establish interpersonal relationships at work.  
Repair and replace wheels and their components.  
Inspect hydraulic and pneumatic systems.  
Maintain and repair suspensions, chassis frames and fifth wheels.  
Inspect electrical and electronic systems.  
Maintain and repair hydraulic power steering systems.  
Maintain and repair hydraulic and pneumatic braking systems.  
Repair transmission systems.  
Repair differential systems.  
Maintain and replace automatic transmissions.  
Maintain and repair charging and starting systems.  
Repair hydraulic equipment on a heavy vehicle.  
Repair cab elements, accessories and circuits.  
Perform general maintenance tasks on diesel injection systems and engine brakes.  
Tune diesel engines.  
Inspect and replace diesel engines.  
Repair diesel engines.  
Perform periodic maintenance on a heavy vehicle.  
Enter the workforce.

## Grid of Competencies

The grid of competencies shows the relationship between general competencies, which correspond to professional activities, and specific competencies, which are required to practise the particular trade or occupation, as well as the major steps in the work process.

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

GRID OF COMPETENCIES																			
HEAVY VEHICLE MECHANICS	Competency number	Type of competency	Duration (in hours)	GENERAL COMPETENCIES										WORK PROCESS					TOTAL
				Determine their suitability for the trade and the training process	Prevent risks with regard to occupational health and safety, and the environment	Find technical information about heavy vehicles	Do shop work	Perform heating, welding and cutting tasks	Establish interpersonal relationships at work	Inspect hydraulic and pneumatic systems	Inspect electrical and electronic systems	Find technical information	Make a diagnosis	Plan the work	Do the work	Perform a test after the work is done			
Competency number				1	2	3	4	5	6	8	10								
Type of competency				S	B	B	B	B	S	B	B								
Duration (in hours)				15	30	45	75	75	30	90	90						450		
Repair and replace wheels and their components	7	B	45	○	●	●	●	○	●	○		▲	▲	▲	▲	△			
Maintain and repair suspensions, chassis frames and fifth wheels	9	B	75	○	●	●	●	●	●	●	○	▲	▲	▲	▲				
Maintain and repair hydraulic power steering systems	11	B	75	○	●	●	●	●	●	●	○	▲	▲	▲	▲				
Maintain and repair hydraulic and pneumatic braking systems	12	B	120	○	●	●	●	○	●	●	●	▲	▲	▲	▲	△			
Repair transmission systems	13	B	120	○	●	●	●	○	●	●	●	▲	▲	▲	▲	▲			
Repair differential systems	14	B	60	○	●	●	●	○	●	●	●	▲	▲	▲	▲	▲			
Maintain and replace automatic transmissions	15	B	45	○	●	●	●	○	●	●	●	▲	▲	▲	▲	▲			
Maintain and repair charging and starting systems	16	B	60	○	●	●	●	○	●	○	●	▲	▲	▲	▲	▲			
Repair hydraulic equipment on a heavy vehicle	17	B	60	○	●	●	●	○	●	●	●	▲	▲	▲	▲	▲			
Repair cab elements, accessories and circuits	18	B	90	○	●	●	●	●	●	●	●	▲	▲	▲	▲	▲			
Perform general maintenance tasks on diesel injection systems and engine brakes	19	B	105	○	●	●	●	○	●	○	●	▲	▲	▲	▲	▲			
Tune diesel engines	20	B	105	○	●	●	●	○	●	○	●	▲	▲	▲	▲	▲			
Inspect and replace diesel engines	21	B	60	○	●	●	●	●	●	●	●	▲	▲	▲	▲	▲			
Repair diesel engines	22	B	120	○	●	●	●	○	●	○	○	▲	▲	▲	▲				
Perform periodic maintenance on a heavy vehicle	23	B	75	○	●	●	●	●	●	●	●	▲	▲	▲	▲	▲			
Enter the work force	24	S	135	●	●	○	○	○	●	○	○	△	△	△	△	△			
Total duration			1350																1800

Links between the general competencies and the specific competencies

- : Existence of a link  
●: Application of a link

Links between the work process and the specific competencies

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

## Harmonization

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

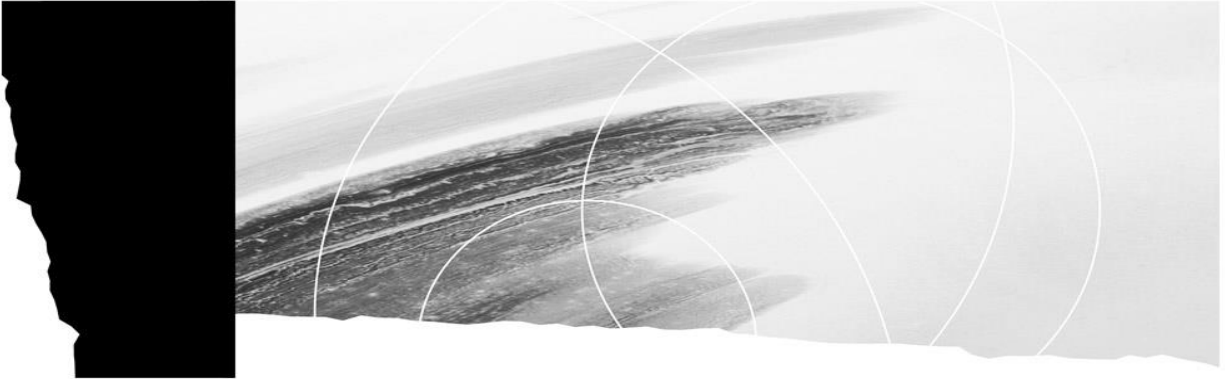
Harmonization establishes consistency between training programs and is especially important in ensuring that the tasks of a trade or occupation are clearly identified and described. Harmonization makes it possible to identify tasks requiring competencies that are common to more than one program. Even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

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

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

Harmonization of the *Heavy Vehicle Mechanics* program has resulted in identifying competencies that are shared with other programs. Detailed information on the harmonization of this program and its results is presented in the document entitled *Tableaux d'harmonisation, Mécanique de véhicules lourds routiers*.





## **Part II**

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### **Program Competencies**



Competency 1                      Duration 15 hours                      Credits 1

---

### ***Situational Competency***

---

#### **Statement of the Competency**

Determine their suitability for the trade and the training process.

#### **Elements of the Competency**

- Be familiar with the nature of the trade.
- Be familiar with the effects of technological developments on the practice of the trade.
- Understand the training program.
- Confirm their career choice.

---

#### **Learning Context**

---

##### **Information Phase**

- Learning about the characteristics of the job market in heavy vehicle mechanics.
- Learning about the nature of the work, working conditions and requirements.
- Learning about professional ethics.
- Learning about the different aspects of technological change and its impact on the work of mechanics.
- Learning about interprovincial labour mobility as it applies to heavy vehicle mechanics.
- Participating in a group discussion about the advantages and requirements of the trade.

##### **Participation Phase**

- Understanding the program of study and the training process.
- Drawing a parallel between the training offered and the work situation of mechanics.
- Sharing their initial reactions to the trade and the training process.
- Discussing the program's potential to help them acquire the versatility needed to develop within the trade or in related fields.
- Learning about opportunities for ongoing training in heavy vehicle mechanics.

##### **Synthesis Phase**

- Producing a report in which they:
  - assess their career choice by comparing the aspects and requirements of the trade with their preferences, aptitudes and interests
  - share their aspirations and career goals

---

**Instructional Guidelines**

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- Create a friendly atmosphere conducive to integration into the workforce.
- Foster discussion between students and encourage them to express themselves.
- Encourage students to actively participate in the suggested activities.
- Help students arrive at an accurate perception of the trade.
- Provide students with the means to assess their career choice honestly and objectively.
- Organize visits to companies representative of the main workplaces in heavy vehicle mechanics or a meeting with trade specialists.
- Help students develop a desire to grow and excel in the trade.
- Encourage students to adopt ethical attitudes and behaviours.
- Provide students with a variety of pertinent documentation.
- Provide a report template and help students produce documents.

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**Participation Criteria**

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**Information Phase**

- Gather information on most of the topics to be covered.
- Present their views on the trade, making connections with the information gathered.

**Participation Phase**

- Carefully read the documents gathered.
- Show an interest when participating in the proposed activities.
- Express their views on the program of study.

**Synthesis Phase**

- Produce a report in which they:
  - explain their career choice, making explicit connections with their preferences, aptitudes and interests
  - reflect on how future opportunities in the trade of heavy vehicle mechanic can help them achieve their career goals

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**Suggestions for Competency-Related Knowledge and Know-How**

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

**Information Phase**

- Situate the competency with respect to the training program.
  - Purpose of the competency
  - Course outline
  - Links with the other competencies
- Refer to the main rules governing group discussion.
  - Participation
  - Respect for others' right to speak and for staying on topic
  - Attention to others' contributions
  - Acceptance of different points of view



- Learn about the characteristics of the job market in heavy vehicle mechanics.
  - Types of companies, job prospects, remuneration, opportunities for promotion and transfer, hiring criteria
- Learn about the nature and requirements of the trade.
  - Tasks and operations
  - Skills, knowledge, attitudes and behaviours
  - Rules of professional ethics
  - Rights and responsibilities of the various parties
- Learn about the aspects of technological change that have an impact on their practice of the trade.
  - New technologies, regulations, materials, etc.
- Share their views on the aspects of the trade encountered during a visit to a company or in discussions with a trade specialist.
  - Perception of aspects deemed positive or negative
  - Identification of aspects they found to be of particular interest

**Participation Phase**

- Examine the training plan.
  - Program of study: competency-based approach, objectives, links between the competencies
  - Evaluation methods and the certification of studies
- Learn about technology watch.
  - Possibilities afforded by ongoing training
  - Seminars, professional development sessions offered by dealers, associations or other groups, etc.
- Explore related trades.
  - Specializations
  - Construction equipment mechanics, agricultural mechanics, diesel and electronic control mechanics, automotive mechanics, customer service representatives, parts sales representatives, etc.
- Share their reactions to the trade, as well as to the program of study and its requirements.
  - Connections between actual work activities and the competencies in the program of study

**Synthesis Phase**

- Write a report justifying their career choice.
  - Report template provided by the teacher
  - Determination of their personal goals
  - Summary of their preferences, aptitudes and interests
  - Summary of the requirements of the trade
  - Brief conclusion



Competency 2                      Duration 30 hours                      Credits 2

### ***Behavioural Competency***

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#### **Statement of the Competency**

Prevent risks with regard to occupational health and safety, and the environment.

#### **Achievement Context**

- Working in a mechanic shop
- Given the necessary documentation

#### **Elements of the Competency**

#### **Performance Criteria**

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- |   |  |
|---|--|
| 1. Take precautions to ensure their own health and safety and that of others. | <ul style="list-style-type: none"><li>• Recognition of dangerous situations in the work environment</li><li>• Determination of appropriate control measures related to:<ul style="list-style-type: none"><li>– the shop layout</li><li>– work methods</li><li>– the work done on the vehicle's various systems</li><li>– the use of electric and pneumatic tools and equipment</li><li>– the handling of loads</li><li>– the handling of products</li><li>– the maintenance and storage of tools and equipment, and workplace maintenance</li><li>– the use of personal protective equipment</li></ul></li><li>• Determination of the appropriate fire-prevention measures to take</li></ul> |
| 2. Take precautions to preserve the quality of the environment.               | <ul style="list-style-type: none"><li>• Recognition of risk situations</li><li>• Determination of appropriate control measures related to:<ul style="list-style-type: none"><li>– the use of toxic and hazardous products</li><li>– the layout of the shop</li><li>– the use of tools and equipment</li><li>– the storage, disposal and recycling of hazardous materials</li><li>– the preservation of air quality in the workshop</li></ul></li></ul>   |
| 3. Intervene in the case of an accident or emergency.                         | <ul style="list-style-type: none"><li>• Recognition of their limits with regard to interventions</li><li>• Determination of an effective method of communicating with:<ul style="list-style-type: none"><li>– emergency services</li><li>– resource people on site</li></ul></li></ul>   |

*For the competency as a whole:*

- Adoption of safe behaviour in all circumstances
- Use of appropriate terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Refer to the laws and regulations respecting occupational health and safety applicable to mechanics.
  - *Act respecting industrial accidents and occupational diseases*
  - *Act respecting owners, operators and drivers of heavy vehicles*
  - Method of consulting documents
- Establish the rights and responsibilities of the parties in terms of health and safety in a mechanic shop.
  - Identification of roles and responsibilities
  - Employers' rights and responsibilities
  - Employees' rights and responsibilities
- Learn about the possible impact of incidents or accidents on their physical and mental well-being.
  - Inhalation of toxic substances, burns, injuries, chilblains and occupational diseases
  - Possible impact on mental health or stability
- Understand the importance of keeping a mechanic shop clean and tidy.
  - Means of preventing falls or collisions with obstacles; avoiding overturning equipment, dropping tools, spilling hazardous products; etc.
- Adopt safe behaviour when working on vehicles.
  - Preventive measures concerning the effects of chemicals on health and safety; the use of compressed air; the use of electric and pneumatic tools; the use of lifting and handling equipment; welding, cutting and heating operations; battery maintenance; and all types of mechanical work
- Locate safety elements in the mechanic shop.
  - Location of emergency exits
  - Location of first-aid kit, fire extinguishers, fire protection equipment, water sources (decontamination shower, eyewash station, etc.), ventilation system controls, etc.
- Choose protective equipment based on the type of work.
  - Collective protective equipment
  - Personal protective clothing and accessories
- Refer to the environmental protection laws and regulations that are applicable to mechanics.
  - Federal environmental protection laws and regulations
  - Provincial laws and regulations respecting volatile organic compounds (VOC), halocarbons (substances that deplete the ozone layer), replacement refrigerants, global warming, smog, etc.
  - Kyoto and Montreal protocols, etc.
- Adopt behaviours that protect environmental quality when working on vehicles.
  - Types of pollution caused by heavy vehicles (direct and secondary)
  - Effects of chemicals on the environment

- Basic principles for preventing environmental pollution
  - Use, storage and disposal of greases, oils and solvents
  - Use of halocarbons, fuels, oxidizers and gases
  - Presence of exhaust gas, etc.
- Consult WHMIS data sheets.
  - pictograms, text
- Record the contact details of emergency resources.
  - Medical personnel, ambulance technicians, firefighters, police officers, community organizations, etc.



Competency 3      Duration 45 hours      Credits 3

***Behavioural Competency***

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**Statement of the Competency**

Find technical information about heavy vehicles.

**Achievement Context**

- Given technical documentation in paper and electronic format
- Given a computer system and peripherals
- In English and French

**Elements of the Competency****Performance Criteria**

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- |  |  |
|--|--|
| 1. Select reference materials.   | <ul style="list-style-type: none"> <li>• Accurate determination of:               <ul style="list-style-type: none"> <li>– the purpose of the search</li> <li>– the type of information sought</li> <li>– the limitations of the search</li> </ul> </li> <li>• Determination of relevant sources of information based on the vehicle type</li> </ul> |
| 2. Find information in technical manuals.                                    | <ul style="list-style-type: none"> <li>• Effective location of required information</li> <li>• Appropriate interpretation of information located</li> <li>• Appropriate determination of key information</li> </ul>  |
| 3. Gather technical information in electronic format.                        | <ul style="list-style-type: none"> <li>• Observance of method for importing files</li> <li>• Appropriate interpretation of information</li> <li>• Effective use of specialized software</li> <li>• Appropriate determination of key information</li> <li>• Observance of procedure for printing and transferring information</li> </ul>              |
| 4. Search the Internet.  | <ul style="list-style-type: none"> <li>• Proper use of search engine</li> <li>• Effective browsing of sites</li> <li>• Appropriate sorting of information collected</li> <li>• Observance of procedure for saving and transferring data</li> <li>• Proper use of email</li> <li>• Production of a concise directory of useful sites</li> </ul>       |
| 5. Locate the general characteristics of heavy vehicle in the documentation. | <ul style="list-style-type: none"> <li>• Accurate identification of vehicle</li> <li>• Appropriate recognition of the vehicle's main parts and systems</li> <li>• Accurate location of information about the vehicle's parts, systems and lifting points</li> </ul>  |

*For the competency as a whole:*

- Appropriate application of search method
- Proper use of computer equipment and paper documents
- Methodical recording of key information
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- List different sources of technical documentation.
  - Print and electronic documentation
  - Manuals, technical sheets and guides, catalogues, etc.
- Use a search method.
  - Definition of the context and scope of the search
  - Planning of search
  - Information or data collection
  - Analysis and sorting of data
  - Recording of key information
- Use a computer, software and peripherals.
  - Procedures for importing, saving, printing, archiving and transferring data, etc.
  - Rules of ergonomics
- Focus a search within reference sources.
  - Table of contents
  - Specific groupings such as categories of parts, materials, etc.
  - Alphabetical and numerical order
  - Special sections in documents
- Understand the meaning of technical texts in English and French.
  - Technical terminology in English and French
  - Keywords and general meaning of the text
- Identify heavy vehicles.
  - Make, model and serial number
  - Main characteristics
- Demonstrate professional ethics.
  - Compliance with copyright law
  - Care taken to keep the material in good condition



Competency 4      Duration 75 hours      Credits 5

***Behavioural Competency***

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**Statement of the Competency**

Do shop work.

**Achievement Context**

- Working in a mechanic shop
- Given instructions specifying the work required
- Given graphical representations
- Using the necessary tools, measuring instruments and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency**

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**Performance Criteria**

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- |  |  |
|--|--|
| 1. Disassemble and reassemble a simple mechanical assembly.  | <ul style="list-style-type: none"> <li>• Relevant connections between the components of the assembly and the graphical representations</li> <li>• Appropriate choice of hand, electric and pneumatic tools</li> <li>• Appropriate selection of fasteners</li> <li>• Proper installation of fasteners</li> <li>• Quality of assemblies</li> <li>• Ability to follow the sequence of operations</li> </ul> |
| 2. Take measurements: <ul style="list-style-type: none"> <li>– in the metric system</li> <li>– in the imperial system</li> </ul> | <ul style="list-style-type: none"> <li>• Selection of appropriate instruments</li> <li>• Careful handling of instruments</li> <li>• Precise adjustment of instruments before measuring</li> <li>• Proper use of instruments</li> <li>• Precise readings</li> <li>• Accurate measurements</li> <li>• Accurate interpretation of measurements</li> </ul>   |
| 3. Work with ferrous and non-ferrous metals at a workbench.  | <ul style="list-style-type: none"> <li>• Observance of cutting, drilling, filing, threading and tapping techniques</li> <li>• Quality of cuts</li> <li>• Successful extraction of a broken fastener</li> <li>• Appropriate installation of thread inserts</li> </ul>   |
| 4. Use the equipment in a mechanic shop.   | <ul style="list-style-type: none"> <li>• Observance of operating procedure</li> <li>• Respect for the capacity of the different pieces of equipment</li> <li>• Appropriate maintenance of equipment</li> <li>• Safe replacement of grinding wheel</li> </ul>   |

*For the competency as a whole:*

- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Draw sketches of mechanical parts.
  - Freehand drawing technique
  - Dimensioning, numbering, annotation
- Select work tools.
  - Names of tools in a mechanic's toolbox and a mechanic shop, manual machining tools and measuring and control instruments
  - Functions of tools and instruments
  - Applications with respect to the job at hand
- Prepare tools for use.
  - Inspection of tools and measuring and control instruments
  - Adjustment and calibration, lubrication, sharpening, cleaning and minor repairs
  - Fastening of accessories
- Select fasteners.
  - Names, classification and coding of threaded and unthreaded fasteners
  - Applications with respect to the job at hand
- Use an effective disassembly and reassembly method.
  - Visualization of the assembly
  - Handling and cleaning of parts
  - Arrangement of disassembled parts and fasteners
  - Reversal of steps
  - Tightening and adjustments
- Use hand tools and measuring instruments.
  - Hand, electric and pneumatic tools
  - Micrometer, dial indicator, caliper, gauges (telescopic, thread, feeler, etc.), ruler, protractor, compass, etc.
  - Applications and limits of tools and instruments
  - Operating procedure and work methods
  - Precautions to take
  - Maintenance and storage after use

- Select and use cutting tools.
  - Drills, blades, files, taps, dies, grinding wheels and reamers
  - Characteristics, properties and ratings
  - Applications with respect to the job at hand
  - Functions and limits of the tools
  - Operating procedure and work methods
  - Operating, maintenance and storage precautions to take
- Select and use pullers.
  - Types of pullers
  - Characteristics and properties
  - Applications with respect to the job at hand
  - Functions and limits of the tools
  - Operating procedure and work methods and sequences
  - Operating, maintenance and storage precautions to take
- Select and use equipment in a mechanic shop.
  - Cleaning of equipment, hydraulic presses, bench vises and grinders, etc.
  - Characteristics and properties
  - Applications with respect to the job at hand
  - Functions and limits of the equipment
  - Preparation of equipment and operating procedure
  - Operating, maintenance and storage precautions to take (including grinding wheel adjustments)
- Select and use lifting and handling equipment.
  - Lift, floor jacks, jack stands, hoist, slings, supports, tools for transporting batteries, etc.
  - Characteristics and properties
  - Applications with respect to the job at hand
  - Functions and limits of the equipment
  - Preparation of equipment
  - Operating procedure
- Maintain a compressed air distribution system.
  - Parts of a compressed air distribution system
  - Purging of air tank and lines
  - Inspection of filters, lubricators, oil levels, seals, hoses and connectors, etc.
  - Control of air pressure supply
  - Application of corrective measures
- Adopt safe behaviour.
  - Use of personal protective equipment
  - Safe work practices
  - Use of products and solvents
  - Recycling and storage of products
  - Start-up of gas exhaust system



Competency 5      Duration 75 hours      Credits 5

***Behavioural Competency***

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**Statement of the Competency**

Perform heating, welding and cutting tasks.

**Achievement Context**

- Working in a mechanic shop
- Working on materials used in heavy vehicles
- Using tools and equipment
- Using the necessary materials
- Given technical documentation
- Using personal and collective protective equipment

**Elements of the Competency**

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**Performance Criteria**

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1. Prepare the work.

- Appropriate preparation of welding station
- Proper assembly of oxyacetylene cutting station
- Leaktightness of oxyacetylene cutting station
- Appropriate choice of:
  - cutting tips
  - preventive measures
- Appropriate adjustment of welding equipment based on the work to be done
- Complete disconnection of vehicle power sources and accessories
- Appropriate preparation of surfaces

2. Heat parts.

- Appropriate recognition of the metal to be heated
- Proper application of heating techniques
- Uniform heating

3. Weld metals.

- Appropriate choice of type of welding based on:
  - the type of repair
  - the metals to be joined
  - the forces exerted on the part
- Proper preparation of part to be welded
- Utilization of proper welding techniques in the following positions:
  - horizontal
  - vertical
  - overhead
- Uniformity and resistance of weld bead
- Adequate penetration of filler
- Reasonable resistance of weld bead

4. Cut metals.

- Proper application of cutting techniques
- Regularity of drag lines
- Clean cuts

## 5. Disassemble the welding station.

- Careful handling of pressure regulators and nozzles
- Proper installation of caps on cylinders
- Safe storage of materials and tools
- Cleanliness of work area and tools

*For the competency as a whole:*

- Observance of occupational health and safety and environmental protection rules
- Appropriate use of welding equipment and tools
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Determine the work to be done based on the material.
  - Characteristics of ferrous and non-ferrous metals
  - Characteristics of alloys
  - Identification of materials to be welded, cut or heated
  - Effects of heat on metal
  - Filler metals
  - Cleaners and antioxidants
- Protect the vehicle and accessories.
  - Disconnection of batteries, accessories, etc.
  - Identification of hazardous components or locations on the vehicle
  - Other protection methods
- Assess the level of risk associated with the work to be done.
  - Hazards associated with the use of compressed gas, oxygen, acetylene and electricity
  - Characteristics of oxidizers and fuels
  - Handling and storage of cylinders
  - Ventilation of work area
  - General characteristics of work area
  - Use of flash shields to secure work area
  - Use of personal protective equipment
- Use heating equipment.
  - Characteristics of equipment
  - Selection of type of equipment
  - Method of using the equipment and work techniques
  - Health and safety rules

- Use welding stations.
  - Characteristics of equipment
  - Selection of type of welding station (semi-automatic, SMAW, homogeneous, heterogeneous)
  - Method of using the equipment and work techniques
  - Health and safety rules
- Use cutting equipment.
  - Characteristics of equipment
  - Selection of type of equipment (oxygen cutting, plasma cutting)
  - Operating procedure for the equipment and work techniques
  - Health and safety rules
- Maintain the equipment.
  - Handling and storage of cylinders
  - Inspection of hoses and nozzles
  - Storage of pressure regulators
  - Cleaning and replacement of cutting tips
  - Inspection of cart and clamps
  - Minor repairs to hoses, power cables and outlets





Competency 6      Duration 30 hours      Credits 2

### ***Situational Competency***

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#### **Statement of the Competency**

Establish interpersonal relationships at work.

#### **Elements of the Competency**

- Be familiar with the principles of communication.
- Communicate in a context specific to heavy vehicle mechanics.
- Establish collaborative ties in a work team.
- Learn about their strengths and weaknesses when communicating.

#### **Learning Context**

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##### **Information Phase**

- Learning about the communication process
- Listing communication difficulties and factors fostering effective communication
- Learning about ways of collaborating in a work team
- Learning about the format and content of a work order

##### **Participation Phase**

- Taking part in scenarios allowing them to apply the different communication techniques used in a mechanic shop
- Taking part in scenarios allowing them to adopt attitudes and behaviours appropriate to different parties
- Taking part in scenarios allowing them to communicate by phone in contexts related to mechanics
- Taking part in scenarios allowing them to adopt the attitudes and behaviours necessary to contribute effectively in a work team
- Entering information on a work order

##### **Synthesis Phase**

- Learning about their strengths and limitations with respect to communication and teamwork
- Producing a report indicating areas requiring improvement during their training

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**Instructional Guidelines**

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- Provide the necessary documentation.
- Facilitate exchanges of views.
- Encourage students to express themselves and assist those who have difficulty communicating.
- Provide the support students need to carry out the activities.
- Foster the application of communication techniques within the group.
- Design scenarios representative of the workplace.
- Help students understand the importance of their attire, cleanliness and general appearance.
- Provide a report plan and editing assistance.

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**Participation Criteria**

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**Information Phase**

- Consult the sources of information made available to them.

**Participation Phase**

- Participate actively in the various activities.
- Identify appropriate communication strategies for heavy vehicle mechanics.
- Identify attitudes and behaviours that foster collaboration in a work team.

**Synthesis Phase**

- Produce a report indicating:
  - their strengths and areas for improvement with respect to communication and teamwork
  - means of correcting their shortcomings

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**Suggestions for Competency-Related Knowledge and Know-How**

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

**Information Phase**

- Identify elements of the communication process.
  - Transmitter: types of language, the message, its construction, its meaning and its transmission codes
  - Receiver: decoding of message, perception and interpretation of codes, feedback
- Identify factors that influence communication.
  - Verbal and non-verbal language
  - Perception and interpretation of message
  - Favourable behaviours: self-confidence, ability to listen, clarity, self-control, openness and receptiveness
  - Unfavourable behaviours: inability to listen, lack of respect or tact, preconceived notions, aggressiveness, confrontation, defensiveness, inappropriate language, etc.

- Identify factors that influence work in a team.
  - Shared goals and objectives
  - Collaboration and cooperation
  - Favourable behaviours: spirit of collaboration, ability to listen, openness, altruism, respect, active participation, etc.
  - Unfavourable behaviours: competitiveness, individualism, prejudice, subjectivism, confrontation, etc.

### Participation Phase

- Deal with different categories of people.
  - Customers, suppliers and subcontractors, co-workers, superiors, etc.
  - Personality types
- Clarify information about a complaint.
  - Technique for approaching the person and welcoming comments
  - Types of questions and reformulations
  - Active listening
  - Atmosphere of trust, courtesy and tact
- Transmit technical information.
  - Answering questions, explaining and justifying work done or to be done, practical information and advice upon delivery of a vehicle, etc.
  - Concise communication of information in easy-to-understand terms
  - Reassurance of customer
- Deal with contingencies.
  - Reactions to pressure and irritants
  - Handling of complaints, requests or specific requirements, problem solving, etc.
  - Self-control, self-assurance, openness to differing opinions, acceptance of criticism, open-mindedness, etc.
- Communicate by phone.
  - Telephone protocol: tone, pronunciation, concision and accuracy of information
- Communicate in a work team.
  - Types of questions to ask to obtain information
  - Reformulation of points of convergence and divergence during discussions
  - Reformulation and mirroring of a message
  - Constructive feedback
  - Expression of their point of view
  - Ways of dealing with emotional behaviours, etc.

### Synthesis Phase

- Assess themselves with respect to communication and collaboration in a work team.
  - Honest approach
  - Positive criticism
  - Self-indulgence



Competency 7      Duration 45 hours      Credits 3

***Behavioural Competency***

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**Statement of the Competency**

Repair and replace wheels and their components.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on the wheels of a heavy vehicle and trailer
- Given technical documentation in paper and electronic format
- Using handling and safety tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Identify a problem with a wheel based on a complaint.

- Accurate identification of the wheel type
- Appropriate identification of work methods based on the wheel type
- Safe installation of vehicle
- Thorough visual inspection of the wheel and its components
- Appropriate determination of the probable source of the problem
- Clear explanation of the problem identified

2. Plan the work.

- Proper determination of the type of repair or research required
- Appropriate search for the manufacturer's recommended removal, disassembly and installation methods
- Proper choice of tools and lifting equipment
- Determination of logical sequence of operations

3. Remove wheels and wheel bearings.

- Thorough observance of manufacturer's recommended work methods for:
  - removing front wheels
  - removing rear wheels
  - removing wheel bearings
- Careful handling of parts

4. Inspect the disassembled parts.

- Appropriate cleaning of parts
- Thorough visual inspection of:
  - wheel bearings
  - cups
  - studs
- Adequate identification of the defective part
- Proper selection of replacement part or substitute

5. Repair:
  - the wheel
  - the hub
  - Appropriate selection of work method based on the type of seal
  - Correct application of methods for replacing defective parts
  - Thorough application of method for reinstalling components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
  - Correct lubrication of bearings
6. Change a defective tire.
  - Thorough observance of manufacturer's recommended work methods for:
    - removing the wheel
    - removing the tire
  - Appropriate cleaning of rim
  - Methodical inspection of rim and tire valve
  - Adequate inflation of tire in safety cage
  - Thorough observance of sequence of operations for installing the tire and wheel
  - Proper torque
7. Verify the quality of the work.
  - Methodical verification of:
    - tire pressure
    - wheel warping
  - Appropriate recording of verification results on the work order
8. Maintain the work area.
  - Appropriate storage of tools, equipment and products
  - Cleanliness of work area

*For the competency as a whole:*

- Rigorous application of occupational health and safety and environmental protection rules
- Appropriate use of tools and equipment
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Select wheels and tires for installation on a vehicle.
  - Based on the hub
  - Types of rims and studs
  - Types and sizes of tires and treads
  - Types of wheel bearings and seals
  - Codes and numbers
- Gather information about a wheel problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics, etc.
  - English and French technical vocabulary, keywords and general meaning of the text
- Lift and stabilize a vehicle.
  - Preparation of equipment
  - Use of lifting equipment and supports
  - Safety rules adapted to the job both inside and outside the shop
- Establish a work plan.
  - Manufacturer's recommended sequence of operations for changing wheels and seals
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Select and prepare the tools and equipment.
  - Specialized tools for removing and installing fasteners
  - Conventional tools
  - Preparation of handling equipment
  - Safe method for installing jack stands
  - Manufacturer's recommendations
- Drain the hub.
  - Draining oil from the front and back wheels
  - Methods and means of recovering used oil
- Apply the manufacturer's recommended removal sequences.
  - Removal of the hub, wheel and tire
  - Memorization of the original position of the components and parts (codes, reference points, chiselling or punching, position and orientation of components, etc.)
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign materials
  - Tightening of wheel

- Inflate tires.
  - Installation of tire in safety cage
  - Installation of hose clamps
  - Correct air pressure
- Apply the manufacturer's recommended installation sequences.
  - Methods of installing the hub and wheel
  - Adjustments
  - Torque and tightening sequences based on the type of hub or wheel
  - Method of checking the wheel for lateral runout
  - Effects of alignment on tire wear
- Lubricate wheel bearings.
  - Oils and greases, grades and classifications
  - Lubrication points and methods
  - Quantity of lubricant based on recommended levels
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Refer to current regulations.
  - Regulation respecting the tightening of hubs and wheels
  - Concern for the safety of persons
- Perform quality work.
  - Cleanliness, order and precision



Competency 8      Duration 90 hours      Credits 6

***Behavioural Competency***

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**Statement of the Competency**

Inspect hydraulic and pneumatic systems.

**Achievement Context**

- Working in a mechanic shop
- Given a work order
- Working on hydraulic and pneumatic systems on heavy vehicles
- Given technical documentation in paper and electronic format
- Using measuring instruments and devices
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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- |  |   |
|--|---|
| 1. Gather technical information about the hydraulic and pneumatic systems to be inspected.   | <ul style="list-style-type: none"> <li>• Selection of pertinent information based on the system: <ul style="list-style-type: none"> <li>– in the technical manuals</li> <li>– in the manufacturer's manuals</li> <li>– in schematics and diagrams of hydraulic and pneumatic systems</li> </ul> </li> <li>• Effective location of required information</li> <li>• Correct interpretation of hydraulic and pneumatic schematics and diagrams, and their annotations, symbols and codes</li> <li>• Realistic interpretation of manufacturer's recommendations and specifications</li> </ul> |
| 2. Plan the inspection.  | <ul style="list-style-type: none"> <li>• Accurate identification of the location of components on the vehicle based on the diagrams</li> <li>• Appropriate determination of measurements to be taken</li> <li>• Determination of logical sequence of operations</li> <li>• Appropriate choice of measuring instruments and devices</li> </ul>   |
| 3. Perform quality control operations on: <ul style="list-style-type: none"> <li>– hydraulic and pneumatic circuits</li> <li>– components</li> </ul> | <ul style="list-style-type: none"> <li>• Thorough visual inspection of circuits and their components</li> <li>• Proper start-up of vehicle</li> <li>• Accurate pressure and flow readings</li> <li>• Methodical recording of measurements on the work order</li> </ul>  |
| 4. Diagnose the hydraulic and pneumatic systems.   | <ul style="list-style-type: none"> <li>• Thorough validation of readings against specifications</li> <li>• Relevance of findings</li> </ul>   |

## 5. Explain the diagnosis.

- Clarity of information entered on the work order
- Appropriate justification of findings
- Proposal of appropriate solutions to the problems identified

*For the competency as a whole:*

- Compliance with the manufacturer's recommended diagnostic sequence
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of measuring instruments and devices
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize hydraulic and pneumatic phenomena in a heavy vehicle.
  - Laws of physics pertaining to hydraulic and pneumatic systems
  - Symbols used in hydraulic and pneumatic system schematics
  - Ability to perform the main calculations
- Visualize the operation of hydraulic and pneumatic circuits on a heavy vehicle.
  - Closed and open circuits
  - Operating principles of series and parallel systems
  - Related phenomena
  - Transformation of hydraulic energy into mechanical energy
  - Hydraulic fluids and their characteristics and classification
  - Names and characteristics of components, their functions, and how they work together
  - Types of pumps, their functions and how they work together; characteristics of their components
- Consult sources of technical information about hydraulic and pneumatic circuits.
  - Methods of finding information based on the source consulted
  - Manufacturers' manuals, schematics, diagrams or graphical representations
  - Print or electronic documents
  - English and French technical vocabulary, keywords and general meaning of the text
- Interpret schematics and diagrams of hydraulic and pneumatic systems.
  - Path of air or fluid in a circuit
  - Instructions for consultation and interpretation
  - Symbols, codes and annotations
  - Representation of hydraulic and pneumatic components
  - Transposition of data from diagrams to the corresponding circuits
  - Anticipation of possible problems

- Refer to the manufacturer's recommended inspection sequence.
  - Steps in the recommended inspection process
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
- Locate verification points on the vehicle.
  - Use of diagrams and graphical representations
  - Application of verification sequence
  - Identification on the vehicle of hydraulic and pneumatic components, pipes and hoses, etc.
- Use their senses to detect problems.
  - Visual, olfactory and tactile acuity
  - Position and condition of hoses, connections, etc.
  - Detection of wear, leaks, dirt, abnormal noises, heat, etc.
- Select and use the appropriate verification tools and devices for hydraulic and pneumatic circuits.
  - Pressure, flow gauges, multimeter, etc.
  - Special connectors for gauges
  - Calibration and adjustment
  - Manufacturer's recommended operating procedure
  - Precautions to take and maintenance
- Maintain a compressor.
  - Inspection of pneumatic circuits, belts, hoses, filters, oil distributor, etc.
- Make a diagnosis.
  - Reference to manufacturer's recommendations
  - Identification of discrepancies
  - Conclusions
  - Explanation of findings
- Draft a work order.
  - Recording and compilation of data
  - Essential elements to include
  - Formatting of information
  - Report including the final data
  - English and French technical vocabulary
- Show concern for efficiency.
  - Logic, curiosity, ability to anticipate problems
  - Visualization of abstract phenomena



Competency 9      Duration 75 hours      Credits 5

***Behavioural Competency***

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**Statement of the Competency**

Maintain and repair suspensions, chassis frames and fifth wheels.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road, including trailers
- Given technical documentation in paper and electronic format
- Using troubleshooting devices and instruments, including computerized diagnostic tools
- Performing common maintenance and repair operations
- Using tools and equipment, including trailer supports
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Gather the technical information required to make the diagnosis.</li> </ol> | <ul style="list-style-type: none"> <li>• Accurate identification of:               <ul style="list-style-type: none"> <li>– type of vehicle and trailer</li> <li>– suspension system</li> <li>– chassis frame</li> <li>– fifth wheel</li> </ul> </li> <li>• Appropriate selection of:               <ul style="list-style-type: none"> <li>– information to look for based on the complaint</li> <li>– information sources to consult</li> </ul> </li> <li>• Methodical search for specifications and work methods</li> <li>• Correct interpretation of graphical representations and mechanical, electrical, electronic and pneumatic schematics and diagrams</li> </ul> |
|---|---|

2. Locate the problem on the vehicle.
  - Thorough visual inspection of the suspension system, chassis frame and fifth wheel with respect to their:
    - mechanical components
    - pneumatic components
    - electrical and electronic components
  - Appropriate choice of measuring instruments and devices
  - Appropriate connection of diagnostic equipment
  - Appropriate verification of efficiency of the system's mechanisms and components:
    - reading of fault codes
    - reading of settings
    - readings of pneumatic pressure
  - Recognition of the probable source of the problem
  - Clear explanation of the problem identified
3. Plan the repair or maintenance work.
  - Appropriate determination of type of repair or maintenance required
  - Appropriate choice and preparation of tools and equipment
  - Adequate selection of products
  - Determination of logical sequence of operations
4. Carry out repairs on:
  - the suspension system
  - the chassis frame
  - the fifth wheel
  - Correct application of manufacturer's recommended removal and installation methods
  - Correct replacement of defective components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
5. Carry out maintenance work on:
  - the suspension system
  - the chassis frame
  - the fifth wheel
  - Methodical application of manufacturer's recommended maintenance sequences
  - Relevant corrections made
  - Application of lubricants at the appropriate points
6. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Full report of work done on the work order

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a suspension system works.
  - Operating principles of mechanical and pneumatic suspensions
  - Components, their characteristics and functions, and how they work together
- Gather information about a suspension problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc.
  - English and French technical vocabulary, keywords and general meaning of the text
- Gather information about the chassis frame and the fifth wheel to be repaired or maintained.
  - Components, their characteristics and functions, and how they work together
  - Specifications for the tractor trailer fifth wheel
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of vehicle, trailer, suspension system, chassis frame and fifth wheel
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
- Establish a work plan.
  - Manufacturer's recommended sequence of operations based on the system or component in question
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to identify defects.
  - Visual, auditory and tactile acuity
  - Verification of tolerances, wear, breakage, leaktightness, etc.

- Select and use verification equipment, tools and instruments.
  - Conventional tools and equipment
  - Calibration bar, pressure gauges, dial gauge, etc.
  - Cutting torch, welding tools, etc.
  - Codes of special tools
  - Operating procedure and work methods
  - Adjustment of instruments, maintenance and storage
- Convey information about the work to be done.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select products.
  - Greases, Teflon, etc.
  - Grades and classifications
- Apply the manufacturer's recommended removal and installation methods.
  - Removal and installation of plates, cushions, cross members and other components
  - Memorization of the original position and orientation of components and parts
  - Torque and tightening sequences, lubrication
- Carry out maintenance checks.
  - Suspension systems: shock absorbers, anchorages, supports, leaf springs, shackles and spring pads, U-bolts, clips, air springs, rubber pads, stop pin, lever arm dampers, travel bumpers, axles, various bars, etc.
  - Coupling device: coupling plate, jaws, pins, supports, slides, locking systems, bushings, etc.
  - Chassis frame: side rails, cross members, joists and other fasteners, vehicle and trailer floor, supports (engine, transmission, tanks), etc.
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Learn about the consequences of defects in suspension systems, chassis frames and fifth wheels.
  - Potential defects and their effects
  - Importance of precise verifications
  - Sense of responsibility
- Perform quality work.
  - Cleanliness, order and precision



Competency 10      Duration 90 hours      Credits 6

***Behavioural Competency***

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**Statement of the Competency**

Inspect electrical and electronic systems.

**Achievement Context**

- Working in a mechanic shop
- Given a work order
- Working on electrical and electronic systems in heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using measuring instruments and devices
- Using conventional tools
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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- |  |  |
|--|--|
| 1. Gather technical information about the electrical or electronic system to be inspected.   | <ul style="list-style-type: none"> <li>• Selection of pertinent information based on the system: <ul style="list-style-type: none"> <li>– in the technical manuals</li> <li>– in the manufacturer's manuals</li> <li>– on electrical and electronic drawings and schematics</li> </ul> </li> <li>• Effective location of required information</li> <li>• Correct interpretation of drawings and schematics, and their annotations, symbols and codes</li> <li>• Realistic interpretation of manufacturer's recommendations and specifications</li> </ul> |
| 2. Plan the inspections to be performed.   | <ul style="list-style-type: none"> <li>• Accurate identification of the location of components on the vehicle based on the diagrams</li> <li>• Appropriate determination of measurements to be taken</li> <li>• Determination of logical sequence of operations</li> <li>• Appropriate choice of measuring instruments and devices</li> </ul>  |
| 3. Perform quality control operations on: <ul style="list-style-type: none"> <li>– electrical and electronic circuits</li> <li>– components</li> </ul> | <ul style="list-style-type: none"> <li>• Thorough visual inspection of circuits and their components</li> <li>• Accurate amperage, voltage and resistance readings</li> <li>• Methodical recording of measurements on the work order</li> </ul>  |
| 4. Make a diagnosis concerning the condition of the electrical or electronic system.   | <ul style="list-style-type: none"> <li>• Thorough validation of readings against specifications</li> <li>• Relevance of findings</li> </ul>  |

## 5. Explain the diagnosis.

- Clarity of information entered on the work order
- Appropriate justification of findings
- Proposal of appropriate solutions to the problems identified

*For the competency as a whole:*

- Compliance with the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety rules
- Appropriate use of measuring instruments and devices
- Appropriate use of English and French terminology
- Attention to the overall condition of the vehicle

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize electrical phenomena in a heavy vehicle.
  - Structure of matter (atoms, electrons, protons, neutrons, ions, etc.)
  - Conductors, semiconductors and insulators
  - Sources of electricity
  - Nature and speed of electricity
  - Ohm's Law and Joule's Law
  - Laws of magnetism and electromagnetism
  - Applications of electricity in heavy vehicles
- Visualize the operation of electrical and electronic circuits in a heavy vehicle.
  - Direct current
  - Series, parallel and mixed series-parallel circuits
  - Operating principles of systems
  - Related phenomena
  - Transformation of electrical energy into thermal energy
  - Relationships between the size of a conductor, amperage and the temperature of the conductor
  - Names and characteristics of components, their functions, and how they work together
- Consult sources of technical information about electrical and electronic circuits.
  - Methods of finding information based on the source consulted
  - Manufacturers' manuals, schematics or graphical representations
  - Documents in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text

- Interpret schematics and diagrams of electrical systems.
  - Path of current in a circuit
  - Instructions for consultation and interpretation
  - Symbols, codes and annotations
  - Visualization of electrical and electronic components
  - Transposition of data from diagrams to the corresponding circuits
  - Anticipation of possible problems
- Refer to the manufacturer's recommended inspection sequence.
  - Steps in the recommended inspection process
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
- Locate verification points on the vehicle.
  - Use of diagrams and graphical representations
  - Types of connectors
  - Use of inspection sequence
  - Position of components, cable harnesses, connectors, etc.
- Use their senses to detect problems.
  - Visual, olfactory and tactile acuity
  - Position and condition of harnesses, connections, wear, etc.
- Select and use the appropriate verification tools and devices for the circuits in question and the types of verifications to be done.
  - Multimeter, ammeter, ohmmeter, indicator light, test leads, etc.
  - Analogue and digital devices
  - Calibration and adjustment
  - Manufacturer's recommended operating procedure
  - Precautions to take and maintenance
- Perform voltage drop tests.
  - Measurement of static and dynamic resistance of a circuit
  - Application to power supply circuits and ground circuits
  - Gauge and code of conductor
- Make a diagnosis.
  - Reference to manufacturer's recommendations
  - Identification of discrepancies
  - Conclusions
  - Explanation of findings
- Document a work order.
  - Recording and compilation of data
  - Essential elements to include
  - Formatting of information
  - Report including the final data
  - English and French technical vocabulary
- Show concern for efficiency.
  - Logic, curiosity and ability to anticipate problems
  - Visualization of abstract phenomena



Competency 11      Duration 75 hours      Credits 5

***Behavioural Competency***

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**Statement of the Competency**

Maintain and repair hydraulic power steering systems.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information required to make the diagnosis.
  - Accurate identification of the vehicle type and hydraulic power steering system
  - Appropriate selection of:
    - information to look for based on the complaint
    - information sources to consult
  - Methodical search for specifications and work methods
  - Correct interpretation of drawings and schematics of the electrical and hydraulic systems
2. Locate the problem on the vehicle.
  - Thorough visual inspection of the hydraulic power steering system:
    - hydraulic components
    - mechanical components
  - Proper selection of diagnostic equipment and instruments
  - Precise system pressure and pump flow readings
  - Recognition of the probable source of the problem
  - Clear explanation of the problem identified
3. Plan the repair or maintenance work.
  - Appropriate determination of type of repair or maintenance required
  - Appropriate choice and preparation of tools and equipment
  - Appropriate selection of products
  - Determination of logical sequence of operations

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|---|--|
| <p>4. Repair:</p> <ul style="list-style-type: none"> <li>– the steering system</li> <li>– its components</li> </ul> | <ul style="list-style-type: none"> <li>• Correct application of the manufacturer's recommended removal method</li> <li>• Careful handling of spindle axis</li> <li>• Correct replacement of defective components</li> <li>• Organized reinstallation of components</li> <li>• Observance of manufacturer's recommended methods and specifications regarding:               <ul style="list-style-type: none"> <li>– tolerances and adjustments</li> <li>– torque and tightening sequences</li> </ul> </li> </ul> |
| <p>5. Perform maintenance work on the steering system.</p>  | <ul style="list-style-type: none"> <li>• Methodical application of manufacturer's recommended maintenance sequence</li> <li>• Relevant corrections made</li> <li>• Application of lubricants at the appropriate points</li> </ul>  |
| <p>6. Maintain the work area.</p>   | <ul style="list-style-type: none"> <li>• Appropriate storage of equipment, tools, instruments and products</li> <li>• Cleanliness of work area</li> </ul>  |

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Full report of work done on the work order
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a hydraulic power steering system works.
  - Operating principles of the steering system and its controls
  - Types of steering boxes and columns
  - Components, their characteristics and functions, and how they work together
  - Steering angles and geometry
  - Functions of oils
- Gather information about a hydraulic power steering system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc., in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text

- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and steering system
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the vehicle and its steering system
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Verification of tolerances and wear, in particular with regard to the spindle axis and links
- Select and use diagnostic equipment, tools and instruments.
  - Conventional tools and equipment
  - Alignment bar, pressure and flow gauges, dial gauge, etc.
  - Heating tools
  - Codes of special tools used to verify steering angles
  - Operating procedure and work methods
  - Adjustment of instruments, maintenance and storage
- Convey information about the work to be done
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select products.
  - Engine oils, hydraulic oils or steering oils
  - Grades and classifications
- Use manufacturer's recommended removal and installation methods.
  - Methods of removing and installing mechanical and hydraulic components
  - Memorization of the original position and orientation of components and parts
  - Adjustment of bearings, torque and tightening sequences, lubrication
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign materials
- Carry out maintenance checks.
  - Oil levels, spindle axis and link tolerances, steering wheel resistance, performance of safety system, operation of column, condition of tubes and hoses, etc.

- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Learn about the consequences of defects in a steering system.
  - Potential defects and their effects
  - Sense of responsibility with respect to road safety
- Perform quality work.
  - Cleanliness, order and precision



Competency 12      Duration 120 hours      Credits 8

***Behavioural Competency***

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**Statement of the Competency**

Maintain and repair hydraulic and pneumatic braking systems.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road and on trailers
- Working on modern hydraulic and pneumatic braking systems, with and without anti-lock braking systems (ABS), with and without traction control systems (TCS), etc.
- Performing common maintenance and repair operations
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency**

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1. Gather the technical information required to make the diagnosis.

**Performance Criteria**

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- Accurate identification of the vehicle type and braking system
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and hydraulic, pneumatic, electrical and electronic schematics and diagrams

2. Locate the problem on the vehicle.
  - Thorough visual inspection of the system:
    - condition of the pneumatic and hydraulic system hoses
    - condition of wires and electrical connections
    - leaktightness of control valves
  - Appropriate selection of diagnostic equipment and devices
  - Appropriate connection of diagnostic tools
  - Appropriate verification of the efficiency of the system's mechanisms and components:
    - reading of fault codes
    - reading of parameters
    - readings of hydraulic and pneumatic pressure
  - Recognition of the probable source of the problem
  - Clear explanation of the problem identified
3. Plan the repair or maintenance work.
  - Appropriate determination of type of repair or maintenance required
  - Appropriate choice and preparation of tools and equipment
  - Proper selection of products
  - Determination of logical sequence of operations
4. Repair:
  - the brakes
  - the hydraulic braking system
  - the pneumatic braking system
  - Correct application of manufacturer's recommended removal methods
  - Appropriate cleaning and inspection of parts removed
  - Proper selection of components or parts to be replaced
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Organized reinstallation of parts and components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
  - System leaktightness
5. Maintain hydraulic and pneumatic braking systems.
  - Methodical application of manufacturer's recommended maintenance sequences
  - Relevant corrections made
6. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Full report of work done on the work order
- Careful handling of components
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a braking system on a heavy vehicle and trailer works.
  - Principles of physics related to hydraulic and pneumatic braking
  - Transfer of general knowledge and skills related to hydraulic and pneumatic systems
  - Service and emergency braking systems
  - Components of braking systems, their characteristics and functions, and how they work together
  - Connections between the braking system and the engine
  - Functions of fluids and air
- Visualize how various types of assisted brakes work.
  - Operating principle of valves
  - Operating principles of ABS, TCS and EBS brakes, etc.
  - Specific characteristics of components of these types of brakes
  - New products on the market
- Gather information about a pneumatic or hydraulic braking system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc., in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and braking system
  - Location on the vehicle of the systems and components represented on the diagrams and technical schematics
  - Symbols, codes and annotations
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the vehicle and its braking system
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization

- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible cause, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Verification of air and fluid leaks, presence of heat, unusual odours, signs of wear, etc.
- Verify the performance of braking system components.
  - Verification of operation of compressor, air chamber, air dryer, valves, air tank, etc.
  - Test methods
  - Verification of thickness of discs and diameter of drums
  - Use of conventional instruments
- Select and use computerized diagnostic tools.
  - Selection of connectors and outlets
  - Connection methods
  - Reading of codes and parameters
- Convey information about the braking system in question.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Apply the manufacturer's recommended removal and installation sequences.
  - Removal of axle shafts and the mechanical, electrical and pneumatic components of a braking system
  - Memorization of the original position and orientation of components and parts
  - Reinstallation and adjustment of bearings, torque and tightening sequences, lubrication
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies
- Repair wires.
  - Splicing, crimping and soldering techniques
- Carry out a final inspection of the braking system.
  - Lubrication oil and brake fluid levels, condition of components, external air and oil leaks, methods for testing certain components
- Bleed a hydraulic braking system.
  - Communicating and collaborating with a co-worker
  - Manufacturer's recommended sequence of operations
  - Topping off and replacement of brake fluid
  - Grades and classifications

- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Demonstrate professional ethics.
  - Concern for the safety of the vehicle's occupants and other road users
  - Sense of responsibility
- Perform quality work.
  - Cleanliness, order and precision



Competency 13      Duration 120 hours      Credits 8

### ***Behavioural Competency***

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#### **Statement of the Competency**

Repair transmission systems.

#### **Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models that are currently on the road
- Working on manual and electronically controlled transmission systems, shafts and joints
- For common repair operations
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using handling tools and equipment
- Using materials and products
- Using personal protective equipment

#### **Elements of the Competency**

#### **Performance Criteria**

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1. Gather the technical information required to make the diagnosis.
  - Accurate identification of the vehicle type and transmission system
  - Appropriate selection of:
    - information to look for based on the complaint
    - information sources to consult
  - Methodical search for specifications and work methods
  - Correct interpretation of graphical representations and mechanical, electrical, electronic and pneumatic schematics and diagrams
2. Locate the problem in the transmission system.
  - Thorough visual inspection of the transmission system:
    - hydraulic components
    - pneumatic components
    - mechanical components
  - Proper selection of diagnostic devices and instruments
  - Appropriate connection of diagnostic tools

- Appropriate verification of the efficiency of the system's mechanisms and components:
    - reading of fault codes
    - reading of parameters
    - readings of pneumatic pressure and clutch adjustment
  - Recognition of the probable source of the problem
  - Clear explanation of the problem identified
3. Plan the repair work.
- Proper determination of type of repair required
  - Appropriate selection and preparation of handling tools and equipment
  - Appropriate selection of products
  - Determination of logical sequence of operations
4. Repair:
- shafts and joints
  - a transmission and its components
  - a clutch
- Correct application of manufacturer's recommended removal and disassembly methods
  - Appropriate cleaning and inspection of parts removed
  - Proper selection of components or parts to be replaced
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Organized reassembly and reinstallation of parts and components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
5. Verify the operation of the transmission system after the repair work.
- Correct application of manufacturer's recommended verification methods
  - Appropriate testing of repaired components
  - Relevant corrections made
  - Full report of work done on the work order
6. Maintain the work area.
- Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle



*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology
- Normal operation of the transmission system

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a transmission system works.
  - Types and models of transmissions and clutches
  - Power takeoffs (PTO)
  - Friction plate materials
  - Path of mechanical energy in different types and models of transmissions
  - Principles of torque multiplication
  - Types of shafts and joints
  - Types and models of fasteners and supports
  - Operating principles of the system
  - Components of the system, their characteristics and functions, and how they work together
- Gather information about a transmission problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc.
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and transmission
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the vehicle and its transmission
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization

- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Verification of clutch adjustments, shaft, joints, heating or overheating, unusual noises, air leaks, etc.
- Test the components of the transmission system.
  - Conventional tools and computerized diagnostic tools
  - Test: shifting, power takeoffs and clutch
- Select and prepare the tools and equipment.
  - Specialized tools for disassembling shafts, clutches and transmissions based on the model, including bearing and U-joint pullers
  - Conventional tools
  - Jacks, fasteners, jack stands, etc.
  - Preparation of handling equipment
  - Safe methods of installing levers and supports
  - Manufacturer's recommendations
- Bleed the transmission accessories (power takeoff) and transmission fluid.
  - Grades and classifications
  - Recovery methods and containers
- Convey information about the transmission system.
  - Verbal exchange
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Apply the manufacturer's recommended removal and disassembly sequences.
  - Removal of joints, shafts, the transmission, the clutch and the power takeoff, as well as their mechanical, electrical and pneumatic components
  - Disassembly of transmission
  - Memorization of the original position of the components and parts (coding, reference points, chiselling or punching, position and orientation of components, etc.)
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies

- Repair wires.
  - Splicing, crimping and soldering techniques
- Reassemble and reinstall transmission components.
  - Manufacturer's recommended sequences of operations
  - Methods for installing components and parts
  - Proper orientation of clutch components
  - Adjustment and timing of the main transmission shaft and driveshaft phasing
  - Adjustment of power takeoff
  - Torque and tightening sequences
  - Lubrication
- Carry out a final inspection of the transmission system.
  - Abnormal noises and vibrations
  - Lubricant levels
  - Condition of external components and accessories
  - External air and oil leaks
  - Test method
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Methodical, precise, clean work and conscientiousness



Competency 14      Duration 60 hours      Credits 4

### ***Behavioural Competency***

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#### **Statement of the Competency**

Repair differential systems.

#### **Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on differentials and axle shafts from heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using diagnostic devices and instruments
- Using handling tools and equipment
- Using materials and products
- Using personal protective equipment

#### **Elements of the Competency**

#### **Performance Criteria**

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- |   |   |
|---|---|
| 1. Gather the technical information required to make the diagnosis. | <ul style="list-style-type: none"><li>• Accurate identification of the vehicle type and differential system</li><li>• Appropriate selection of:<ul style="list-style-type: none"><li>– information to look for based on the complaint</li><li>– information sources to consult</li></ul></li><li>• Methodical search for specifications and work methods</li><li>• Correct interpretation of graphical representations and electrical, electronic and pneumatic schematics and diagrams</li></ul> |
| 2. Locate the problem in the vehicle's differential system.         | <ul style="list-style-type: none"><li>• Thorough visual inspection of the differential system:<ul style="list-style-type: none"><li>– leaktightness (air, oil)</li><li>– condition of wires and electrical connections</li></ul></li><li>• Appropriate verification of the efficiency of the system's mechanisms and components</li><li>• Recognition of the probable source of the problem</li><li>• Clear explanation of the problem identified</li></ul>                                       |
| 3. Plan the repair work.  | <ul style="list-style-type: none"><li>• Proper determination of type of repair required</li><li>• Appropriate choice and preparation of tools and equipment</li><li>• Appropriate selection of products</li><li>• Determination of logical sequence of operations</li></ul>   |

4. Repair:
    - an axle shaft
    - a differential
  5. Verify the operation of the differential system after the repair work.
  6. Maintain the work area.
- Safe installation of handling equipment
  - Correct application of manufacturer's recommended removal and disassembly methods
  - Appropriate cleaning and inspection of disassembled parts
  - Proper selection of components or parts to be replaced
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Organized reassembly and reinstallation of parts and components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
  - Correct application of manufacturer's recommended verification methods
  - Full report of work done on the work order
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how differential systems work.
  - Types of models of differentials and axle shafts
  - Path of mechanical energy in different types and models of differentials
  - Principle of power distribution
  - Operating principles of systems
  - Components of the systems, their characteristics and functions, and how they work together
- Gather information about a differential system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc., in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and differential system
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the vehicle and the differentials
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Verification of leaktightness, heating or overheating, unusual noises, air leaks, etc.
- Select and prepare the tools and equipment.
  - Specialized tools for disassembling differential bearings and joints
  - Conventional tools
  - Jacks, fasteners, jack stands, etc.
  - Preparation of handling equipment
  - Safe methods of installing levers and supports
  - Manufacturer's recommendations and safety rules

- Apply the manufacturer's recommended removal and disassembly sequences.
  - Removal of operating shaft, axle shafts and their mechanical, electrical and pneumatic components
  - Disassembly of differential
  - Memorization of the original position of the components and parts (codes, reference points, chiselling or punching, position and orientation of components, etc.)
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies
- Convey information about the transmission system.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Reassemble and reinstall disassembled components.
  - Manufacturer's recommended sequence of operations
  - Methods for installing components and parts
  - Adjustment of bearings and gears (pinion, crown gear)
  - Torque and tightening sequences
  - Lubrication (oil pump)
  - Topping up or replacement of oil
  - Grades and classifications
- Repair wires.
  - Splicing, crimping and soldering techniques
- Carry out a final inspection of the system.
  - Abnormal noises and vibrations
  - Lubrication oil level
  - Condition of external components and accessories
  - External air and oil leaks
  - Test method
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Method, precision, cleanliness and conscientiousness



Competency 15      Duration 45 hours      Credits 3

***Behavioural Competency***

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**Statement of the Competency**

Maintain and replace automatic transmissions.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road
- Working on electronically or manually controlled automatic transmissions
- For common maintenance operations
- Given technical documentation in paper and electronic format
- Using diagnostic devices and instruments, including computerized diagnostic tools
- Using handling tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information required to make the diagnosis.

- Accurate identification of the vehicle type and automatic transmission system
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and electrical, electronic and hydraulic schematics and diagrams

2. Locate the problem in the automatic transmission system.

- Accurate verification of leaktightness of the transmission's hydraulic system
- Proper selection of diagnostic devices and instruments
- Appropriate connection of diagnostic tools
- Appropriate verification of the efficiency of the transmission system's mechanisms and components:
  - reading of fault codes
  - reading of parameters
  - readings of controls and adjustments
- Recognition of the probable source of the problem
- Clear explanation of the problem identified

3. Plan the transmission maintenance or repair work.
  - Appropriate determination of type of repair or maintenance required
  - Appropriate selection and preparation of handling tools and equipment
  - Appropriate selection of products
  - Determination of logical sequence of operations
4. Perform maintenance operations on the automatic transmission system.
  - Thorough visual inspection of the transmission system:
    - oil level
    - condition of connectors
    - adjustment of controls and gear selector
  - Correct replacement of filters
  - Appropriate cleaning and inspection of parts removed
  - Topping up of oil in accordance with manufacturer's recommendations
  - Corrective measures applied in accordance with manufacturer's recommendations
5. Remove and install the automatic transmission.
  - Correct application of manufacturer's recommended removal methods
  - Appropriate cleaning and inspection of parts removed
  - Correct application of methods of installing the transmission
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
6. Verify the operation of the automatic transmission system.
  - Correct application of manufacturer's recommended verification methods
  - Appropriate testing of components after the work
  - Full report of work done on the work order
7. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how an automatic transmission system works.
  - Types and models of automatic transmissions
  - Power takeoffs (PTO)
  - Friction plate materials
  - Path of mechanical energy in different types and models of transmissions
  - Principles of torque multiplication
  - Types and models of fasteners and supports
  - Operating principles of the system
  - Components, their characteristics and functions, and how they work together
- Gather information about a transmission system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc.
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and transmission
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the vehicle and its transmission
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Position and condition of hoses, connections, etc.
  - Detection of leaks, dirt, abnormal noises, heat, etc.
- Test the automatic transmission system.
  - Detection of problems related to slipping, shifting, the condition of the oil, etc.
  - Load test, testing of power takeoffs
  - Conventional instruments and electronic diagnostic tools

- Use computerized diagnostic tools.
  - Selection of connectors and outlets on the automatic transmission
  - Connection methods
  - Readings of codes and parameters
- Convey information about the automatic transmission system.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select and prepare the tools and equipment.
  - Conventional tools, jacks, fasteners, jack stands, etc.
  - Preparation of handling equipment
  - Method of installing levers and supports
  - Manufacturer's recommendations and safety rules
- Bleed the transmission oil.
  - Grades and classifications
  - Methods of bleeding and recovering used oils
  - Recovery containers
- Apply the manufacturer's recommended removal and installation sequences.
  - Removal of mechanical, electrical and hydraulic components of the transmission system
  - Memorization of the original position and orientation of components and parts
  - Reinstallation, adjustment of controls, torque and tightening sequences
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies
- Carry out a final inspection of the automatic transmission system.
  - Abnormal sounds, vibrations, fluid levels, condition of external components and accessories, oil leaks
  - Test methods
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Method, precision, cleanliness and conscientiousness

Competency 16      Duration 60 hours      Credits 4

### ***Behavioural Competency***

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#### **Statement of the Competency**

Maintain and repair charging and starting systems.

#### **Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using diagnostic devices and instruments
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

#### **Elements of the Competency**

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#### **Performance Criteria**

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1. Gather the technical information required to make the diagnosis.
  - Accurate identification of the vehicle type and charging and starting systems
  - Appropriate selection of:
    - information to look for based on the complaint
    - information sources to consult
  - Methodical search for specifications and work methods
  - Correct interpretation of graphical representations and electrical and electronic schematics and diagrams
2. Locate the problem in the charging and starting system.
  - Thorough visual inspection of circuit components:
    - batteries
    - alternator
    - belts
    - wires and connectors
  - Proper selection of diagnostic tools and measuring instruments
  - Accurate readings:
    - battery voltage
    - alternator output
    - wiring continuity
  - Recognition of the probable source of the problem
  - Clear explanation of the problem identified

3. Plan the maintenance and repair work.
  - Appropriate determination of type of repair or maintenance required
  - Appropriate choice and preparation of tools and equipment
  - Appropriate selection of products
  - Determination of logical sequence of operations
4. Maintain batteries.
  - Appropriate verification of battery voltage and condition of battery terminals
  - Correct and safe connection of cables or charger
  - Appropriate use of tools and cleaners
5. Repair:
  - the alternator
  - the starter
  - the wires and connections
  - Proper application of methods of removing:
    - the alternator
    - the batteries
    - the starter
  - Correct application of repair techniques:
    - replacement of components
    - repair of wires
  - Adjustment of belts in accordance with requirements
  - Organized reinstallation of components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
6. Verify the operation of the system after the repairs.
  - Correct verification of:
    - starter current draw test
    - charging system output
    - pulley alignment
    - belt tension
  - Relevant corrections made
  - Full report of work done on the work order
7. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology
- Normal operation of the charging and starting systems

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a charging and starting system works.
  - Laws of physics relating to magnetism and electromagnetism
  - Principles of electricity (alternating and direct current) and chemistry associated with batteries
  - Types of charging and starting systems and their operating principles
  - Main components of a battery, an alternator, a starter, solenoids and coils, their characteristics and functions, and how they work together
  - Charging and starting system circuits, connections and safety elements
- Gather information about a charging and starting system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc.
  - English and French technical vocabulary, keywords and sentences, general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and charging and starting systems
  - Location, on the vehicle, of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Manufacturer's recommended sequence of operations for batteries, alternators, starters, wires and connectors
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings

- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Verification of belt adjustment, overheating of starting system and alternator flow
- Select and use diagnostic equipment, tools and instruments.
  - Multimeter, load tester, induction clamp, device for verifying alternators and starters, etc.
  - Conventional tools, charger, etc.
- Convey information about the work to be done.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select products.
  - Distilled water, sulfuric acid, sodium bicarbonate, dielectric grease
- Replace defective parts.
  - Methods of removing and installing an alternator, a battery and a starter
  - Memorization of the original position and orientation of components and parts
  - Torque and tightening sequences
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies
- Repair wires.
  - Splicing, crimping and soldering techniques
- Perform maintenance verifications on batteries.
  - Cleaning of battery and terminals
  - Topping up of electrolyte if applicable
  - Verification of battery capacity based on specifications and state of charge
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Perseverance in research, precision, order and cleanliness



Competency 17      Duration 60 hours      Credits 4

***Behavioural Competency***

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**Statement of the Competency**

Repair hydraulic equipment on a heavy vehicle.

**Achievement Context**

- Working in a mechanic shop
- Given a work order
- Working on hydraulic equipment from heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments
- Using handling tools and equipment
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information required to make the diagnosis.

- Accurate identification of the vehicle type and hydraulic system
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and electrical, hydraulic and pneumatic schematics and diagrams

2. Locate the problem on the vehicle.

- Thorough visual inspection of components and circuits:
  - cylinders
  - hoses and connections
  - pump and controls
  - tank
- Proper selection of diagnostic equipment and measuring instruments
- Accurate readings:
  - pressure
  - pump flow
  - restrictions in the system
- Recognition of the probable source of the problem
- Clear explanation of the problem identified

3. Plan the repair work.

- Proper determination of type of repair required
- Appropriate choice and preparation of tools and equipment
- Appropriate selection of products
- Determination of logical sequence of operations

4. Repair:
  - the hydraulic system
  - the hydraulic control unit
  - the electronic control unit
  - Correct application of manufacturer's recommended removal methods
  - Appropriate cleaning and inspection of parts removed
  - Proper selection of components or parts to be replaced
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Organized reinstallation of parts and components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
5. Verify the operation of the systems.
  - Correct application of manufacturer's recommended verification methods
  - Relevant corrections made
  - Full report of work done on the work order
6. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Careful handling of components
- Appropriate use of English and French terminology
- Normal operation of the equipment

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how hydraulic equipment controls work.
  - Hydraulic, pneumatic, electrohydraulic and proportional controls
  - Operating principles
  - Components, their characteristics and functions, and how they work together
  - Types of electric and electrohydraulic valves
- Gather information about a hydraulic equipment problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc., in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and hydraulic systems
  - Location on the vehicle of the hydraulic and electrical systems and components represented on the schematics and technical drawings
  - Symbols, codes and annotations
- Establish a work plan.
  - Manufacturer's recommended sequence of operations
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Unusual noises, leaks, heating, overheating, etc.
- Apply the manufacturer's recommended removal sequences.
  - Removal of mechanical, electrical and hydraulic components
  - Memorization of the original position and orientation of components and parts
  - Reinstallation, adjustment, torque and tightening sequences, lubrication
- Repair wires.
  - Splicing, crimping and soldering techniques

- Convey information about the work to be done.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Importance of cleanliness and safety
  - Vigilance and precision

Competency 18      Duration 90 hours      Credits 6

***Behavioural Competency***

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**Statement of the Competency**

Repair cab elements, accessories and circuits.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road
- Working on cab elements, accessories and mechanical and electrical circuits
- Performing common repair operations
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information required to make the diagnosis.

- Accurate identification of the vehicle type
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and mechanical, electrical and electronic schematics and diagrams

2. Locate the problem on the vehicle.

- Thorough visual inspection of the systems:
  - mechanical components
  - electrical components
- Proper selection of diagnostic equipment and measuring instruments
- Appropriate verification of the efficiency of the system's mechanisms and components:
  - reading of fault codes on the dashboard
  - reading of parameters
  - voltage, amperage and temperature readings
- Recognition of the probable source of the problem
- Clear explanation of the problem identified

3. Plan the repair work.
  - Proper determination of the type of repair required
  - Appropriate choice and preparation of tools and equipment
  - Determination of logical sequence of operations
4. Repair:
  - the heating-defrosting system
  - the lighting and signalling system
  - windshield wipers
  - power windows
  - seats
  - safety belts
  - hoods, doors, weather stripping, rear-view mirrors, etc.
  - Correct application of manufacturer's recommended removal methods
  - Appropriate cleaning and inspection of parts removed
  - Proper selection of components or parts to be replaced
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Organized reinstallation of parts and components
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
5. Verify the operation of the system after the repairs.
  - Correct application of manufacturer's recommended verification methods
  - Relevant corrections made
6. Verify the operation of the air-conditioning system.
  - Correct application of the system testing method
  - Accurate reading of electrical measurements
  - Appropriate determination of the probable source of the problem
  - Clear explanation of the problem identified
7. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Full report of work done on the work order
- Appropriate use of English and French terminology

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how elements of the cab work.
  - Types of cab systems and accessories (mechanical, electrical and pneumatic), including air-conditioning and multiplex systems
  - Operating principles of each system and accessory
  - Components, their characteristics and functions, and how they work together
- Gather information about a problem related to a cab element, accessory or electrical circuit.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams, etc., in paper or electronic format
  - English and French technical vocabulary, keywords and general meaning of the text
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the vehicle type and systems
  - Location on the vehicle of systems and components represented on the technical schematics and diagrams
  - Symbols, codes and annotations
- Establish a work plan.
  - Manufacturer's recommended sequence of operations
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Find the source and cause of problems.
  - Symptom and diagnostic troubleshooting trees
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Identification of presence and source of heat, unusual sounds, incorrect timing, odour of overheating, etc.
- Select and prepare the tools and equipment.
  - Multimeter, press, lifting equipment, welding tools, etc.
  - Preparation of handling equipment and installation methods
  - Manufacturer's recommendations and safety rules
- Use computerized diagnostic tools.
  - Reading of fault codes on the dashboard
  - Reading of parameters

- Apply the manufacturer's recommended removal and installation sequences.
  - Removal of mechanical, electrical and pneumatic components
  - Memorization of the original position and orientation of components and parts
  - Reinstallation, adjustment, torque and tightening sequences, lubrication
- Repair wires.
  - Splicing, crimping and soldering techniques
- Convey information about defective elements of the cab.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Carry out a final verification of the repaired elements of the cab.
  - Abnormal sounds, vibrations, condition of external components and accessories, air leaks, timing, etc.
  - Test method based on the cab element
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Method, precision, cleanliness and conscientiousness



Competency 19      Duration 105 hours      Credits 7

***Behavioural Competency***

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**Statement of the Competency**

Perform general maintenance tasks on diesel injection systems and engine brakes.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road or on a test bench
- Working on mechanical, hydraulic and electronic injection systems
- Working on engine brakes applied to the engine valve mechanism
- Performing common maintenance operations
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information required to make the diagnosis.

- Accurate identification of:
  - type of engine
  - electronic controls
  - injection system
  - engine braking system
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and mechanical, hydraulic, electrical and electronic schematics and diagrams

2. Before removing, inspect:
  - the injection system
  - the engine brake
  - Thorough visual inspection of the injection and engine braking systems
  - Proper selection of diagnostic equipment and measuring instruments
  - Appropriate connection of diagnostic tools
  - Appropriate verification of the efficiency of the supply system source for the hydraulic and electronic injection:
    - reading of fault codes
    - reading of parameters
    - supply pressure, voltage and sensor readings
  - Complete recording of measurements
3. Perform maintenance checks:
  - on an injection system
  - on an engine brake
  - Correct application of sequence of operations for removing the systems and their components
  - Methodical application of manufacturer's recommended maintenance sequences
  - Record snapshot of system parameters
4. Make a diagnosis.
  - Appropriate verification of measurements using symptom troubleshooting trees
  - Proper determination of the source of the problem and the appropriate corrective measures
  - Clear explanation of the problem identified
5. Apply the corrective measures.
  - Correct application of techniques:
    - replacement of components and parts
    - repair of wires
    - adjustment of parameters
  - Organized reinstallation of components and systems
  - Adjustments in accordance with requirements
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
  - Application of lubricants at the appropriate points
  - Adequate starting of engine
6. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Careful handling of components
- Full report of work done on the work order
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how an internal combustion engine works.
  - Types of internal combustion engines
  - Engine operating cycles
  - Components, their characteristics and functions, and how they work together
- Visualize how the different diesel injection systems work.
  - Principles of physics relating to injection
  - Transfer of general knowledge and skills related to hydraulic systems
  - Types of primary and secondary fuel systems
  - Types of pumps and injectors
  - Operating principles of systems
  - Components, their characteristics and functions, and how they work together
  - Electronic control modules and their controllers
- Visualize how engine brakes work.
  - Principles of physics relating to hydraulics
  - Types of engine brakes
  - Operating principles and links with the engine
  - Mechanical, electrical and electronic components, their characteristics and functions, and how they work together
  - Electronic controls
- Gather information about a diesel injection system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides, technical schematics or diagrams
  - English and French technical vocabulary, keywords and general meaning of the text

- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the engine, injection system and engine brakes
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the type of engine, injection systems and engine brake
  - Location on the vehicle of the systems and components represented on the schematics and technical drawings
  - Symbols, codes and annotations
- Find the source and cause of problems.
  - Symptom and diagnostic tables
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Verification of temperatures, tolerances, wear and vibrations
- Select and use verification equipment, tools and instruments.
  - Specialized tools and equipment
  - Instruments such as a multimeter, pressure gauges, a pyrometer, a dial gauge, etc.
  - Diagnostic software
  - Calibration and adjustment
  - Manufacturer's recommended operating procedure
  - Precautions to take and maintenance
- Convey information about the work to be done.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select products.
  - Types of solvents, fuels, oils and silicones
  - Grades and classifications
- Apply the manufacturer's recommended removal and installation sequences.
  - Methods of removing and installing the different components of diesel injection systems and engine brakes
  - Memorization of the original position and orientation of parts and components
  - Torque and tightening sequences
- Apply the manufacturer's recommended maintenance sequence.
  - Verification of air and fuel filters
  - Inspection of air intake and fuel system
  - Engine tests at every rpm and testing of electric and electronic systems

- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Learn about the consequences of diesel injection system and engine brake defects.
  - Potential defects, their effects and their consequences for road user safety
  - Impact on fuel economy, the quality of the environment and the lifespan of the engine
  - Responsibility
- Perform quality work.
  - Cleanliness, order and precision



Competency 20      Duration 105 hours      Credits 7

***Behavioural Competency***

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**Statement of the Competency**

Tune diesel engines.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road or on a test bench
- Working on air intake, fuel supply, exhaust gas cooling and electronic injection systems
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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1. Gather the technical information needed to tune diesel engines.

- Accurate identification of:
  - engine type
  - systems and accessories
  - electronic controls
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Methodical search for specifications and work methods
- Correct interpretation of graphical representations and mechanical, hydraulic, electrical and electronic schematics and diagrams

2. Inspect the systems prior to disassembly.

- Thorough visual inspection of the fuel supply, air intake and exhaust systems
- Proper selection of diagnostic equipment and measuring instruments
- Appropriate connection of diagnostic tools
- Appropriate verification of the efficiency of the power source for the hydraulic and electronic injection:
  - reading of fault codes
  - reading of parameters
  - pressure readings
- Complete recording of measurements

3. Make a diagnosis.
  - Appropriate verification of measurements using a troubleshooting tree
  - Recognition of the source of the problem and the appropriate corrective measures
  - Clear explanation of the problem identified
4. Apply the corrective measures.
  - Correct application of sequence of operations for removing and disassembling the systems and their components
  - Thorough application of the manufacturer's recommended tuning procedure
  - Organized reassembly and reinstallation of components and systems
  - Adjustments in accordance with requirements
  - Observance of manufacturer's recommended methods and specifications regarding:
    - tolerances and adjustments
    - torque and tightening sequences
5. Verify the operation of the diesel engine.
  - Correct engine start-up procedure
  - Relevant corrections made
  - Full report of work done on the work order
6. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology
- Normal operation of the engine and accessories

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a diesel engine's systems and accessories work.
  - Transfer of knowledge and skills related to injection and air intake systems
  - Types of air supply (variable geometry turbo), fuel supply, cooling, exhaust gas recirculation and electronic injection systems and their operating principles
  - Components, their characteristics and functions, and how they work together



- Gather information about a diesel injection system problem.
  - Consultation of work order
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Identification of information in the manufacturer's manuals, technical guides and technical schematics or diagrams
  - English and French technical vocabulary, keywords and general meaning of the text
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the engine
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Transpose data found in the technical documentation to a real-life situation.
  - Identification of the type of engine, injection systems and engine brake
  - Location on the vehicle of the systems and components represented on the diagrams and technical schematics
  - Symbols, codes and annotations
- Find the source and cause of problems.
  - Symptom and diagnostic tables
  - Deductive method of identifying problems: analysis of the complaint, plausible causes, investigation, findings
  - Reading of supply pressures and measurements on the injectors and sensors
- Use their senses to detect problems.
  - Visual, auditory, olfactory and tactile acuity
  - Well-developed sense of observation
  - Verification of temperatures, tolerances, wear and vibrations
- Select and use verification equipment, tools and instruments.
  - Specialized tools and equipment
  - Instruments such as a multimeter, pressure gauges, a pyrometer, a dial gauge, etc.
  - Diagnostic software
  - Calibration and adjustment
  - Manufacturer's recommended operating procedure
  - Precautions to take and maintenance
- Refer to current regulations.
  - Regulations respecting volatile organic compounds (VOC) and diesel particulate filters (DPF)
- Convey information about the work to be done.
  - Oral communication
  - Nature of the problems identified, type and scope of repairs, consequences
  - Arguments and justification of diagnosis
- Select products.
  - Types of solvents, fuels, oils and silicones
  - Grades and classifications

- Replace defective parts.
  - Methods of removing and installing the different components of diesel engine systems and accessories
  - Memorization of the original position and orientation of parts and components
  - Torque and tightening sequences
- Carry out a final inspection of the system.
  - Abnormal noises, vibrations, verification of engine at every rpm, leaks, smoke, etc.
  - Manufacturer's recommended test methods
- Record the work done on the work order.
  - Compilation of data throughout the process
  - Essential elements to include
  - Formatting of information
  - English or French technical vocabulary
- Perform quality work.
  - Impact of work on the safety of road users
  - Impact on fuel economy, the quality of the environment and the lifespan of the engine
  - Responsibility and thoroughness
  - Cleanliness, order and precision

Competency 21      Duration 60 hours      Credits 4

***Behavioural Competency***

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**Statement of the Competency**

Inspect and replace diesel engines.

**Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on a transport truck engine
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using handling tools and equipment
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Gather the technical information required to make the diagnosis.</li> </ol> | <ul style="list-style-type: none"> <li>• Accurate identification of the vehicle type and engine</li> <li>• Appropriate selection of:               <ul style="list-style-type: none"> <li>– information to look for based on the complaint</li> <li>– information sources to consult</li> </ul> </li> <li>• Methodical search for specifications and work methods</li> <li>• Correct interpretation of graphical representations and mechanical, electrical, electronic and hydraulic schematics and diagrams</li> <li>• Appropriate consultation of the data sheet for the refrigerant used</li> </ul> |
| <ol style="list-style-type: none"> <li>2. Locate the problem on the engine.</li> </ol>                                | <ul style="list-style-type: none"> <li>• Proper selection of diagnostic equipment and instruments</li> <li>• Appropriate verification of engine efficiency:               <ul style="list-style-type: none"> <li>– reading of fault codes</li> <li>– reading of parameters</li> <li>– oil pressure, crankcase compression and pressure and temperature readings</li> </ul> </li> <li>• Accurate verification of leaktightness of cooling system</li> <li>• Recognition of the probable source of the problem</li> <li>• Clear explanation of the problem identified</li> </ul>                          |
| <ol style="list-style-type: none"> <li>3. Plan the work.</li> </ol>   | <ul style="list-style-type: none"> <li>• Proper determination of the appropriateness of replacing the engine</li> <li>• Appropriate selection and preparation of handling tools, equipment and rigging</li> <li>• Appropriate selection of products</li> <li>• Determination of logical sequence of operations</li> </ul>   |

4. Remove the engine from the vehicle.
  - Correct removal of parts to access the engine
  - Complete draining of fluids
  - Complete disconnection of:
    - wires and connections
    - pipes
  - Recovery of refrigerant gases in compliance with regulations
  - Reliable and safe stabilization of the transmission and vehicle
  - Proper mounting of engine in accordance with manufacturer's recommendations
  - Correct fastening of wiring harnesses and hoses
5. Ensure the proper operation of accessories.
  - Observance of sequence of operations for removing and installing different types of accessories
  - Thorough visual inspection of engine and accessories
  - Correct verification of:
    - starter current draw
    - alternator output
    - clutch system and steering wheel
    - leaktightness of crankshaft seals
    - thermostat opening temperature
  - Relevant corrections made
6. Install the engine.
  - Observance of manufacturer's recommended sequence of installation operations
  - Appropriate topping up of fluids
  - Recharge of air-conditioning system in compliance with regulations
  - Appropriate testing of engine
  - Full report of work done on the work order
7. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area and vehicle

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Appropriate use of English and French terminology
- Normal operation of the engine and accessories

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**Suggestions for Competency-Related Knowledge and Know-How**

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

- Visualize how a diesel engine works.
  - Types of diesel engines
  - Operating principles of lubrication, cooling and air-conditioning systems
  - Main components of diesel engines, their characteristics and functions, and how they work together
  - Composition and function of lubricants
- Gather information about a diesel engine problem.
  - Consultation of work order
  - Identification of the type of engine and its characteristics
  - Consultation of various sources of information about how to remove the engine
  - English and French technical vocabulary, keywords and general meaning of the text
- Establish a work plan.
  - Sequence of operations recommended by the manufacturer of the engine and the vehicle
  - Minor adaptations to deal with constraints
  - Limits of the work to be done
  - Development of a sense of organization
- Select and prepare the tools and equipment.
  - Rigging and handling equipment: rails, chains, slings, overhead crane, winch, etc.
  - Numbered markers for wires and pipes
  - Conventional tools, heating and welding tools
  - Safe method of installing levers and supports
  - Manufacturer's recommendations
- Bleed oils, refrigerant gases and coolants.
  - Recovery methods
  - Recovery containers
  - Regulations respecting volatile organic compounds (VOC) and halocarbons
- Identify wires, connections and pipes.
  - Coding
  - Marking, punching, drawing, etc.
- Protect removed accessories.
  - Turbo, clutch, thermostat, pumps, etc.
  - Contamination factors
  - Means of protecting against infiltration of foreign bodies
- Test the vehicle.
  - Limited test (drive, reverse)
  - Verification of fluid levels (engine oil, steering oil, antifreeze, etc.) and antifreeze concentration
  - Verification of leaks (pressurized cooling system)
  - Mechanical verification of oil pressure

- Adopt safe and environmentally responsible behaviour.
  - Reference to occupational health and safety rules, in particular with respect to measures relating to lifting and stabilizing the engine and vehicle
  - Reference to regulations relating to environmental protection, in particular the regulation respecting diesel engine emission pollutants
  - Preventive measures
- Perform quality work.
  - Method, precision and cleanliness
  - Concern for protecting the engine and adjacent parts of the vehicle
  - Conscientiousness

Competency 22      Duration 120 hours      Credits 8

### ***Behavioural Competency***

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#### **Statement of the Competency**

Repair diesel engines.

#### **Achievement Context**

- Working in a mechanic shop
- Given a complaint from a work order
- Working on heavy vehicle models currently on the road
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments
- Using tools and equipment
- Using materials and products
- Using personal protective equipment

#### **Elements of the Competency**

#### **Performance Criteria**

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1. Plan the work.

- Accurate identification of the type of engine
- Appropriate selection of:
  - information to look for based on the complaint
  - information sources to consult
- Appropriate determination of techniques based on the type of repair
- Identification of relevant methods and specifications in the technical documentation
- Proper choice of tools and equipment

2. Disassemble a diesel engine.

- Observance of manufacturer's recommended disassembly procedure
- Proper cleaning of the different parts
- Methodical identification of parts based on their position
- Organized arrangement of parts

3. Determine the condition of the components of the diesel engine block and cylinder head.

- Thorough visual inspection of each part and component
- Observance of recommended inspection methods for each component
- Correct interpretation of readings with respect to manufacturer's specifications
- Appropriate verification of leaktightness of valves
- Recognition of the probable source of the problem
- Clear explanation of the problem identified

4. Repair the engine block and cylinder head.
  - Correct application of manufacturer's recommended methods for:
    - repairing the engine
    - replacing components
  - Observance of specifications
5. Reassemble the diesel engine.
  - Observance of assembly sequence
  - Observance of manufacturer's recommended methods and specifications regarding:
    - torque and tightening sequences
    - tolerances and adjustments
  - Proper selection of sealants
  - Correct application of sealants
  - Proper installation of gaskets and ring seals

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Careful handling of components
- Appropriate use of English and French terminology

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### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Gather information about a diesel engine problem.
  - Consultation of work order
  - Identification of the type of engine and its characteristics
  - Establishment of scenarios concerning possible defects
  - Orientation of information search based on the scenarios selected
  - Consultation of various sources of technical information (manufacturer's manuals, technical guides, diagrams or technical schematics, etc.)
  - English and French technical vocabulary, keywords and general meaning of the text
- Apply the manufacturer's recommended disassembly sequences.
  - Disassembly of cylinder head and block
  - Identification and selection of sequences of operations in the technical documentation
  - Memorization of the original position of the components and parts (codes, reference points, chiselling or punching, position and orientation of components, etc.)
  - Precautions to take to avoid contaminating components and parts or prevent infiltration of foreign bodies
  - Autonomy



- Find the source and cause of defects.
  - Components to be inspected: cylinder head and accessories; crankshaft and bearings; oil pump; camshaft and bearings; pistons; connecting rods and liner; cylinder block; etc.
  - Findings
- Convey information about the engine.
  - Nature of problems found
  - Type and scope of repairs
  - Consequences
  - Arguments and justification of diagnosis
  - Advice
- Select and use tools.
  - Conventional and specialized tools (segment compressor, liner puller, etc.)
  - Codes
  - Manufacturer's recommendations
  - Adjustments and maintenance
- Select products.
  - Cleaners and sealants
  - Compatibility of products
  - Possible chemical reactions
  - Manufacturer's recommendations
  - Replacement products
  - Technological developments
- Reassemble the cylinder block and head.
  - Manufacturer's recommended sequences of operations
  - Methods for installing components and parts
  - Adjustments
  - Lubrication
  - Torque and tightening sequences
- Adopt safe and environmentally responsible behaviour.
  - Work methods
  - Load handling
  - Use of products
  - Organization of work area
  - Use of personal protective equipment, etc.



Competency 23      Duration 75 hours      Credits 5

***Behavioural Competency***

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**Statement of the Competency**

Perform periodic maintenance on a heavy vehicle.

**Achievement Context**

- Working in a mechanic shop
- Given a work order and maintenance schedule for the preventive maintenance program (PMP)
- Working on heavy vehicle models currently on the road, including tractors, straight-body trucks and trailers
- Given technical documentation in paper and electronic format
- Using diagnostic equipment and instruments, including computerized diagnostic tools
- Using handling tools and equipment
- Using personal protective equipment

**Elements of the Competency****Performance Criteria**

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- |  |   |
|--|---|
| <p>1. Plan the maintenance work.</p>   | <ul style="list-style-type: none"> <li>• Accurate identification of the vehicle type and equipment</li> <li>• Appropriate identification of:               <ul style="list-style-type: none"> <li>– maintenance sequence for the vehicle and equipment</li> <li>– specifications</li> </ul> </li> <li>• Proper selection of maintenance schedule for the type of maintenance to be done</li> <li>• Appropriate selection and preparation of tools, instruments and equipment</li> </ul> |
| <p>2. Perform the recommended inspections of:</p> <ul style="list-style-type: none"> <li>– engine</li> <li>– transmission system</li> <li>– electrical and electronic systems</li> <li>– hydraulic and pneumatic systems</li> <li>– body panels</li> </ul> | <ul style="list-style-type: none"> <li>• Safe lifting of vehicle</li> <li>• Thorough visual inspection of recommended verification points</li> <li>• Correct application of verification methods for each system</li> <li>• Accurate readings and measurements</li> <li>• Accurate diagnosis</li> <li>• Proper determination of maintenance work to be done</li> </ul>  |
| <p>3. Perform maintenance work on the systems.</p>   | <ul style="list-style-type: none"> <li>• Correct application of methods:               <ul style="list-style-type: none"> <li>– cleaning</li> <li>– lubrication</li> <li>– oil change</li> <li>– system adjustment</li> </ul> </li> <li>• Use of manufacturer's recommended products</li> <li>• Adequate topping off of oil and other fluids</li> </ul>   |

- 4. Do repairs.
  - Proper selection of replacement components
  - Correct application of repair techniques:
    - replacement of components and parts
    - repair of wires
  - Accurate adjustment of replaced components
  - System leaktightness
  - Correct application of testing methods to repaired systems
- 5. Maintain the work area.
  - Appropriate storage of equipment, tools, instruments and products
  - Cleanliness of work area

*For the competency as a whole:*

- Thorough application of the manufacturer's recommended diagnostic approach
- Observance of occupational health and safety and environmental protection rules
- Appropriate use of tools, instruments and equipment
- Complete recording of verifications and work done on maintenance sheets and the work order
- Appropriate use of English and French terminology

### **Suggestions for Competency-Related Knowledge and Know-How**

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

- Find information in the technical documentation.
  - Pictograms, verification sequences and methods, specifications, work methods
  - Inspection and maintenance schedules specific to vehicles or fleets
- Implement safety measures when maintaining a heavy vehicle.
  - Lifting and handling
  - Disconnection of systems and accessories before doing the work
  - Precautions to take with hazardous and toxic products
- Select the work order and inspection sheets.
  - Types of vehicle (tractor, straight body truck, trailer)
  - Maintenance: daily, weekly, monthly, yearly or according to manufacturer's requirements
  - Information about the preventive maintenance program (PMP)
- Select the appropriate tools and instruments for periodic maintenance.
  - Tire gauge, magnetic dial gauge, inspection kit for cooling system (pressurization, acidity), etc.
  - Special tools for brakes, fifth wheels, etc.
  - Heating and welding tools
  - Multimeter, load tester, computerized diagnostic tools, etc.

- Inspect the engine.
  - Cooling system leak test, acidity check, engine oil pressure test, belt tension, leaktightness and restriction of air intake system, etc.
- Inspect the transmission system.
  - Condition and level of transmission and differential oils; leaktightness of pneumatic (transmission, brakes) and hydraulic systems; condition and level of hydraulic and steering oils; adjustment of clutch; condition of wheels and tires, etc.
- Inspect electrical and electronic systems.
  - Lighting, charging and starting systems, batteries, etc.
- Verify the level of performance of hydraulic and pneumatic accessories.
  - Efficiency of the pump, control, cylinder and hydraulic motor
  - Efficiency of the compressor and regulator
- Inspect body panels.
  - Adjustment of elements of the cab, including doors, windows, headlights and mirrors
  - Operation of signals and indicator lamps, windshield washer and wipers, air-conditioning system components, etc.
  - Condition of side rails and cross members of the vehicle and the trailer
- Perform routine maintenance work.
  - Lubricating; changing oils and filters; adjusting all engine, steering and brake fluids; adjusting brakes, clutches and fifth wheels; repairing the lighting system
- Do routine repairs as part of periodic maintenance.
  - Repairing and replacing wires on the vehicle and trailer, replacing brake shoes, replacing worn or defective components, replacing worn tires, adjusting brakes and clutches, repairing wires, etc.
- Demonstrate professionalism.
  - Respect for the property of others
  - Professional language
  - Concern for road safety
- Perform quality work.
  - Cleanliness, order and precision



Competency 24      Duration 135 hours      Credits 9

## ***Situational Competency***

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### **Statement of the Competency**

Enter the workforce.

### **Elements of the Competency**

- Look for an internship position.
- Observe and perform activities in the workplace.
- Communicate with co-workers.
- Compare their training with their view of the actual workplace during their internship.

### **Learning Context**

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#### **Information Phase**

- Learning about the terms and conditions of the internship
- Defining their expectations and needs with respect to the internship
- Finding establishments that are able to meet their expectations and needs
- Writing a resumé and a cover letter
- Taking steps to obtain an internship position

#### **Participation Phase**

- Observing mechanics go about their tasks
- Performing or helping perform various work-related tasks
- Communicating with colleagues and the internship supervisor
- Complying with the rules of the internship and the establishment
- Producing a report on the tasks and operations performed during the internship

#### **Synthesis Phase**

- Discussing with classmates their experience and the tasks and operations performed in the workplace
- Assessing the relevance of their learning with respect to workplace requirements

### **Instructional Guidelines**

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- Provide students with the means and help they need to find an internship position.
- Maintain close collaboration between the school and the company.
- Make sure that students are constantly supervised by a responsible person in the company.
- Prepare students to assume their responsibilities and respect workplace requirements.
- Provide regular support and supervision and intervene in the case of difficulties.
- Make sure that the company respects the conditions of the internship designed to allow students to achieve the necessary objectives.
- Encourage students to share their opinions.
- Provide a model report.

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**Participation Criteria**

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**Information Phase**

- List workplaces that meet their selection criteria in order of priority.
- Look for an internship position.

**Participation Phase**

- Follow the company's instructions with respect to activities, work schedules and the rules of professional ethics.
- Write an internship report on the activities performed.
- Show sustained interest throughout the internship.

**Synthesis Phase**

- Participate in discussions about their experience and about the tasks and operations performed during the internship.
- Emphasize the strengths and weaknesses of the training received.

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**Suggestions for Competency-Related Knowledge and Know-How**

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

**Information Phase – Search for an Internship Position**

- Learn about the terms and conditions of the internship in the workplace.
  - Objectives of the internship, length, supervision, requirements, participation criteria, rules of the establishment
- Plan an internship search.
  - Select one or more potential workplaces
  - Draft a resumé and letter of introduction
  - Establish first contact, undergo a selection interview and follow up
- Establish their expectations and needs.
  - Personal and occupational objectives
  - Criteria for selecting an establishment
  - Potential for achieving the internship objectives
  - Criteria consistent with expectations
- Find establishments that are able to meet their expectations and needs.
  - Consultation of various sources
  - Location of establishments that have hired trainees in the past and examination of the information available about previous internships
  - Teacher's assistance



- Take steps to obtain an internship position:
  - Contact with employer and agreement about the terms and conditions of the internship
  - Submission to the employer of a list of tasks needed for them to successfully complete the internship
  - Confirmation of internship
  - Collection of documents required for the internship
- Compliance with regulations:
  - Conditions for insurance
  - Registration with the CNESST
  - Agreements with the union
  - Parties' responsibilities

### **Participation Phase – Activities in the Workplace**

- Integrate into the work team:
  - Observation and observance of work methods
  - Observance of work schedule
- Adopt attitudes and behaviours conducive to a successful internship:
  - Qualities appreciated by employers
  - Attitudes making it possible to get the most out of the experience
  - Application of the rules of professional ethics
- Record information during the internship:
  - Keeping a log
  - Useful and important elements to incorporate into a report of the experience
- Observe tasks:
  - Observation of the work context, the tasks performed, the application of regulations and the rules of professional ethics, etc.
  - Introduction to new work techniques or processes
  - Recording of observations in the log
- Try new tasks:
  - Active participation in the internship
  - Performance or participation in the performance of a task
  - Participation in the development of original projects
  - Occupational health and safety rules
  - Company rules and guidelines
  - Recording of tasks in the log
- Communicate with the people around them:
  - Work or informal meetings, teamwork, search for and transmission of information
  - Acceptance of advice and comments
  - Feedback
  - Verification of the satisfaction of the internship supervisors

- Draw up a list of the activities performed during the internship:
  - Content of an internship report
  - Report of activities observed and performed on a daily basis
  - Procedures followed or new technologies used, new learning, problems encountered and solutions found, etc.
  - Comments received about their performance of tasks
  - Use of log

### **Synthesis Phase – Assessment of Their Internship and Training**

- Determine whether they met their objectives:
  - Self-assessment
- Discuss their opinions with classmates after the internship:
  - Report on their experience
  - Mention of positive elements and level of satisfaction
  - Mention of problems encountered and solutions found
  - Perception of the trade before and after the internship
  - Use of internship report
- Compare the learning acquired during the program with the activities observed or performed in the workplace:
  - Identification of the aspects of the trade that are consistent or inconsistent with their training with respect to the workplace, trade practices, employment requirements, etc.



