

## ECVET ASSET

Presentation of the four identified units open to mobility  
and their related  
assessment grid and validation criteria

The units identified by ECVET ASSET and presented in this document will be acquired within the framework of a three-week mobility period by students in initial training.

These units will be assessed by the host institution, hence the necessity to establish validation criteria, assessment grid and marking guidelines to ensure that these units are assessed in a consistent way by the ECVET ASSET partners in the four countries and enhance mutual trust and transparency.

For each unit of learning outcomes open to mobility, the following documents have been elaborated:

- A small fiche presenting the conditions to access the unit (including technical and methodology pre-requisites) and the condition of validation of the unit (including the nature and duration of the assessment test, the objective of the assessment test and the necessary material to carry out the assessment);
- Presentation of the unit in knowledge, skills and competences;
- The assessment criteria for each key competence of the unit and their related coefficient; and
- Marking guidelines to ensure consistent interpretation of the assessment criteria.

## **UNIT 1: VEHICLE STABILITY MANAGEMENT SYSTEMS**

### **1. CONDITIONS OF ACCESS TO THE UNIT:**

#### **TECHNICAL PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Complete the maintenance on a standard breaking system (excluding ABS)

#### **METHODOLOGY PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Read an electrical diagram
- Identify the interactions of the peripheral systems
- Use an oscilloscope to visualise the signals from vehicle's systems
- Do tests with the help of a diagnostic tool
- Choose the appropriate documents for the job to be done

### **2. VALIDATION OF UNIT 1:**

**Test:** practical evaluation in a real situation allowing the acquisitions obtained during the training course to be evaluated

**Objective of the evaluation:** Evaluate the capacities of the candidate to establish a diagnostic on a vehicle stability management system using the appropriate information and testing methods, and to repair the fault.

**Duration:** 2 hours 30 maximum

#### **Material Necessary:**

Written information about the problem

Vehicle presenting a malfunction on the vehicle stability management system

All useful technical documents

Equipped work station/ multimeter/ oscilloscope/ diagnostic tool....

#### **NB**

The evaluation is to be done by at least two instructors competent in the professional domain of automobile maintenance.

## UNIT 1: VEHICLE STABILITY MANAGEMENT SYSTEMS

KNOWLEDGE	SKILLS	COMPETENCE
<p><b>K1:</b> <u>Wheel anti lock break systems:</u></p> <p>K1.1: Theory of Operation Integrated system Additional system</p> <p>K1.2: Study of the Circuits Electrical Circuit (input/output) Hydraulic Circuit</p> <p>K1.3: Strategy of the logic controller</p> <p>K1.4: Diagnostic, maintenance and servicing</p> <p><b>K2:</b> <u>Antiskid systems:</u></p> <p>K2.1: Theory of Operation</p> <p>K2.2: The electrical circuits (inputs/outputs)</p> <p>K2.3: The hydraulic circuits</p> <p>K2.4: Interaction between the auxiliary systems</p> <p>K2.5: Diagnostic, maintenance and servicing</p> <p>K2.6: Particularities of the control of the four-wheel drive system</p> <p><b>K3:</b> <u>Stability control systems:</u></p> <p>K3.1: Theory of Operation</p> <p>K3.2: The electrical circuits</p> <p>K3.3: The hydraulic circuits</p> <p>K3.4: Sensors (inputs/outputs)</p> <p>K3.5: Diagnostic, maintenance and servicing</p>	<p><b>S1:</b> Identify the elements constituting the wheel anti lock break system, the electrical and hydraulic connections and the particularities of the antiskid system and stability control</p> <p><b>S2:</b> Establish a diagnostic procedure taking into account the possible interactions between the peripheral systems</p> <p><b>S3:</b> Apply a testing procedure</p> <p><b>S4:</b> Choose the nature of the action to be taken</p> <p><b>S5:</b> Repair / Replace the components of vehicle stability management systems</p>	<p><b>C1:</b> <u>Diagnose and repair a vehicle stability management system</u></p> <p>C1.1: Identify with precision the symptoms of the fault</p> <p>C1.2: Select the hypotheses of the fault depending on the symptoms</p> <p>C1.3: Test the system</p> <p>C1.4: Validate the malfunction and choose the appropriate action to be done</p> <p>C1.5: Respect the methods and schedule</p> <p><b>C2:</b> <u>Organise the work respecting health and safety rules</u></p>

## ASSESSMENT OF UNIT 1

### VEHICLE STABILITY MANAGEMENT SYSTEM

<b><u>Moment of assessment :</u></b>	At the end of the training period corresponding to Unit 1
<b><u>Time limit :</u></b>	2 hours 30
<b><u>Nature of assessment :</u></b>	Practical assessment in a real situation

<p><b><u>Objective :</u></b></p> <ul style="list-style-type: none"> <li>- Establish a diagnostic on a vehicle stability management system using the appropriate information and testing methods, and repair it.</li> </ul> <p><b><u>Context :</u></b></p> <ul style="list-style-type: none"> <li>- During the diagnostic, the diagnostic tool may be used to take parameter readings or actuator test readings (but excluding fault readings).</li> <li>- The documents provided must be exhaustive allowing the student to do a thorough research of information.</li> </ul>	<p><b><u>Material Necessary :</u></b></p> <ul style="list-style-type: none"> <li>- Written information about the problem</li> <li>- A vehicle presenting a malfunction on the vehicle stability management system The malfunction is plausible and allows only a limited number of hypotheses to be given and values to be taken</li> <li>- A job sheet.</li> <li>- All useful technical documents relative to the vehicle</li> <li>- Equipped work station</li> <li>- Testing Equipment (connector, specific terminal block...)</li> <li>- Oscilloscope</li> <li>- Multimeter</li> <li>- Diagnostic Tool</li> </ul>
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## UNIT 1

### DIAGNOSTIC AND MAINTENANCE OF THE VEHICLE STABILITY MANAGEMENT SYSTEM

COMPETENCE	ASSESSMENT CRITERIA	Marks 0, 1, 2, or 3	Coef	Total
<b>Identify with precision the symptoms of the fault</b>	The malfunction is validated. The documents and information used are adapted to : - the vehicle - the system that has the fault.		<b>1</b>	
<b>Select the hypotheses of the fault depending on the symptoms</b>	The hypotheses given are : - plausible - complete - ranked		<b>1</b>	
<b>Test the system</b>	The diagnostic procedure is : - coherent / logical - adapted to the malfunction		<b>1</b>	
	The choice of the reference values used is adapted to the system with the fault The testing equipment chosen allows the measurements to be taken.		<b>1</b>	
<b>Validate the malfunction and choose the appropriate action to be done</b>	The measurements are chosen in relation to the malfunction and the access points. The equipments are used respecting health and safety guidelines.		<b>1</b>	
	The interpretation of the measured values allows the identification of the causes of the fault. The causes of the malfunction are validated and justified.		<b>2</b>	
	The selected procedures allow the vehicle to be repaired. The malfunction is repaired		<b>1</b>	
<b>Organise a work station</b>	The organisation of the work station is practical Environmental, and health and safety rules are respected The work station and vehicle are kept clean throughout the session		<b>1</b>	
<b><u>Respect the methods and schedule</u> *</b>	The task is completed within a defined time (2 H 30 maximum).		<b>1</b>	

*\* Special conditions      Mark authorised: 0 or 3*

<b>TOTAL :</b>	<b>30</b>
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## MARKING GUIDELINES

### Unit 1 - VEHICLE STABILITY MANAGEMENT SYSTEM

<b>DIAGNOSTIC AND MAINTENANCE OF THE VEHICLE STABILITY MANAGEMENT SYSTEM</b>		
<b>COMPETENCE</b>	<b>ASSESSMENT CRITERIA</b>	<b>Marks</b>
Identify with precision the symptoms of the fault	The malfunction was not validated and the correct documents were not selected	0
	The malfunction was validated but the correct documents were not selected or the malfunction was not validated but several of the correct documents were selected	1
	The malfunction was validated, the correct documents were identified but some of the information needed was not selected	2
	The malfunction was validated, the correct documents were identified and all of the information needed was selected	3
Select the hypotheses of the fault depending on the symptoms	No hypothesis was given	0
	A few hypotheses were given but were either not plausible or in the wrong order	1
	Most of the hypotheses were given but some were either not plausible or in the wrong order	2
	All the hypotheses were given and were plausible, complete and ranked in the correct order	3
Test the system	No procedure or logic to diagnostic	0
	Several attempts at choosing a diagnostic procedure but without success	1
	Correct diagnosis method chosen, but some procedures are not coherent, logical or adapted to the fault.	2
	Correct diagnosis method chosen and procedures are coherent, logical and adapted to the fault.	3
	No suggestions of reference values given	0
	Correct reference values given but incorrect choice of equipment, or incorrect reference values given but correct choice of equipment	1
	Most of the reference values given are correct with a correct choice of equipment	2
	Correct equipment selected and correct reference values given.	3
Validate the malfunction and choose the appropriate action to be done	The measurements are not taken at accesible points depending on the fault, and no knowledge of the equipment.	0
	The measurements are not taken at accesible points depending on the fault but the equipment is used correctly.	1
	The measurements are taken at accesible points depending on the fault place, but some difficulties in using the equipment.	2
	The correct measurements are taken at accesible points depending on the fault and the equipment is used correctly	3
	Values are not interpreted so no cause identified	0
	Some values are correctly interpreted but no cause identified	1

	Most values are correctly interpreted and the cause found but with hesitation and lack of justification	2
	Values are correctly interpreted	3
	No attempt to repair the vehicle.	0
	Several attempts to repair the vehicle but without success	1
	Vehicle is repaired but it does not conform to specifications.	2
	Vehicle is repaired completely and conforms to specifications	3
Organise a work station	Work station is not functional, dirty and no health and safety regulations are respected.	0
	Work station is functional but dirty and no health and safety regulations are respected.	1
	Work station is functional, clean and most health and safety regulations are respected.	2
	Work station is functional, clean and all health and safety regulations are respected.	3
Respect the methods and schedule	The task is not completed within the time limit of 2 hours 30	0
	The task is completed within a time limit of 2 hours 30	3



## **UNIT 2: INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES**

### **1. CONDITIONS OF ACCESS TO THE UNIT:**

#### **TECHNICAL PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Undertake basic maintenance on a petrol engine

#### **METHODOLOGY PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Read a basic electrical diagram
- Explain the basic theory of combustion
- Use an oscilloscope to visualise the signals from vehicle's systems
- Choose the appropriate documents for the job to be done

### **2. VALIDATION OF UNIT 2:**

**Test:** practical evaluation in a real situation allowing the acquisitions obtained during the training course to be evaluated

**Objective of the evaluation:** Evaluate the capacities of the candidate to establish a diagnostic on injection and ignition systems in petrol engines using the appropriate information and testing methods, and to repair the fault.

**Duration:** 2 hours 30 maximum

#### **Material Necessary:**

Written information about the problem

Vehicle presenting a malfunction on the injection and ignition systems.

All useful technical documents

Equipped work station/ multimeter/ oscilloscope/ diagnostic tool....

#### **NB**

The evaluation is to be done by at least two instructors competent in the professional domain of automobile maintenance.

## UNIT 2 : INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES

KNOWLEDGE	SKILLS	COMPETENCE
<p><b><u>K1:</u></b> General description</p> <p>K1.1: Combustion K1.2: Fuel K1.3: Advanced theory of combustion</p> <p><b><u>K2:</u></b> Indirect injection system</p> <p>K2.1: Fuel supply system K2.2: Fuel pressure K2.3: Air supply system K2.4: Electrical circuits K2.5: The different ignition systems K2.6: Control unit input and output signals K2.7: Diagnostic tools K2.8: Diagnostic, maintenance and servicing</p> <p><b><u>K3:</u></b> Direct injection system</p> <p>K3.1: Air fuel ratio K3.2: Diagnostic, maintenance and servicing</p>	<p><b>S1:</b> Explain physical phenomena of combustion in petrol engines</p> <p><b>S2:</b> Identify the elements of the injection and ignition systems</p> <p><b>S3:</b> Explain how each element of the injection and ignition system works</p> <p><b>S4:</b> Use electrical diagrams for fault diagnosis</p> <p><b>S5:</b> Measure pressure and flow</p> <p><b>S6:</b> Establish a diagnostic procedure to identify the fault</p> <p><b>S7:</b> Apply the diagnostic procedure using the diagnostic tools</p>	<p><b><u>C1:</u></b> Diagnose and repair a <u>vehicle stability management system</u></p> <p>C1.1: Identify with precision the symptoms of the fault C1.2: Identify the causes of the fault C1.3: Test the system C1.4: Validate the malfunction and choose the appropriate action to be done C1.5: Respect the methods and schedule</p> <p><b><u>C2:</u></b> Organise the work respecting <u>health and safety rules</u></p>

# INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES

<b><u>Moment of assessment :</u></b>	At the end of the training period corresponding to Unit 2
<b><u>Time limit :</u></b>	2 hours 30
<b><u>Nature of assessment :</u></b>	Practical assessment in a real situation

<p><b><u>Objective :</u></b></p> <ul style="list-style-type: none"> <li>- Establish a diagnostic on an injection or ignition system on different engines using the appropriate information and testing methods, and repair it.</li> <li>- Develop personal skills and competences</li> <li>- Improve problem solving</li> </ul> <p><b><u>Context :</u></b></p> <ul style="list-style-type: none"> <li>- Continuous teacher supervision</li> <li>- Provide the documents for the task</li> <li>- During preparation time possibility to practice in groups</li> <li>- Create alternative, special, and artificial malfunctions on the vehicle tested.</li> </ul>	<p><b><u>Material Necessary :</u></b></p> <ul style="list-style-type: none"> <li>- Data and test form</li> <li>- A vehicle presenting a malfunction on the injection or ignition system.</li> </ul> <p><b>The malfunction is plausible( created by a computer) and allows only a limited number of hypotheses to be given and values to be taken.</b></p> <ul style="list-style-type: none"> <li>- A job sheet</li> <li>- All useful technical documents relative to the vehicle</li> <li>- Equipped work station</li> <li>- Testing Equipment (connector, specific terminal block...)</li> <li>- Multimeter</li> <li>- Diagnostic Tool</li> </ul>
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## UNIT 2

### DIAGNOSTIC AND MAINTENANCE OF THE INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES

COMPETENCE	ASSESSMENT CRITERIA	Marks 0, 1, 2, or 3	Coef	Total
<b>Identify with precision the symptoms of the fault</b>	Identify the parameters of the vehicle Choose the appropriate diagnostic tool Use the diagnostic tool Identify the malfunction		<b>1</b>	
<b>Identify the causes of the fault</b>	The origin of the malfunction The characteristics of the malfunction (single, permanent or repetitive) Making hypothesis of the fault (in written form as well) Organisation of the work process, using documents		<b>1</b>	
<b>Test the system</b>	The choice of the reference values used is adapted to the system with the fault The testing equipment chosen allows the measurements to be taken.		<b>2</b>	
<b>Validate the malfunction and choose the appropriate action to be done</b>	The measurements retained are chosen in relation to the malfunction and the access points. The equipment is used respecting health and safety guidelines.		<b>1</b>	
	The interpretation of the measured values allows the causes of the fault to be identified and to restart the procedure if necessary. The causes of the malfunction are validated and justified.		<b>2</b>	
	The functions selected allows the vehicle to be repaired. The malfunction is repaired		<b>1</b>	
<b>Organise a work station</b>	The organisation of the work station is practical Environmental, and health and safety rules are respected The work station and vehicle are kept clean throughout the session		<b>1</b>	
<b><u>Respect the methods and schedule</u> *</b>	The task is completed within a defined time (2 H 30 maximum).		<b>1</b>	

**\* Special conditions**      **Mark authorised: 0 or 3**

<b>TOTAL :</b>	30
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## MARKING GUIDELINES

### Unit 2 - INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES

<b>DIAGNOSTIC AND MAINTENANCE ON INJECTION AND IGNITION SYSTEMS IN PETROL ENGINES</b>		
<b>COMPETENCE</b>	<b>ASSESSMENT CRITERIA</b>	<b>Marks</b>
Identify with precision the symptoms of the fault	Incorrect identification of the parameters of the vehicle (cannot step forward)	0
	Selection of appropriate diagnostic tool	1
	Professional use of diagnostic tool	2
	Correct identification of fault without assistance	3
Identify the causes of the fault	Cannot identify the origin of the fault	0
	Identify the character of the fault (occasional, permanent or repetitive)	1
	Make hypothesis (including written)	2
	Identify the origin of the fault and organise the process of work.	3
Test the system	No suggestions of reference values given	0
	Correct reference values given but incorrect choice of equipment or incorrect reference values given but correct choice of equipment	1
	Most of the reference values given are correct with a correct choice of equipment	2
	Correct equipment selected and correct reference values given.	3
Validate the malfunction and choose the appropriate action to be done	The measurements are not taken at accessible points depending on the fault, and no knowledge of the equipment	0
	The measurements are not taken at accessible points depending on the fault but the equipment is used correctly.	1
	The measurements are taken at accessible points depending on the fault place, but some difficulties in using the equipment.	2
	The correct measurements are taken at accessible points depending on the fault and the equipment is used correctly	3
	Values are not interpreted so no cause identified	0
	Some values are correctly interpreted but no cause identified	1
	Most values are correctly interpreted and the cause found but with hesitation and lack of justification	2
	Values are correctly interpreted	3
	No attempt to repair the vehicle.	0
	Several attempts to repair the vehicle but without success	1
	Vehicle is repaired but it does not conform to specifications.	2
	Vehicle is repaired completely and conforms to specifications	3
Organise a work station	Work station is not functional, dirty and no health and safety regulations are respected.	0
	Work station is functional but dirty and no health and safety regulations are respected.	1
	Work station is functional, clean and most health and safety regulations are respected.	2
	Work station is functional, clean and all health and safety regulations are respected.	3
Respect the methods and schedule	The task is not completed within the time limit of 2 hours 30	0
	The task is completed within a time limit of 2 hours 30	3

## **UNIT 3: WHEEL ALIGNMENT**

### **1. CONDITIONS OF ACCESS TO THE UNIT:**

#### **TECHNICAL PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Complete basic maintenance on suspension and steering systems

#### **METHODOLOGY PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Choose the appropriate documents for the job to be done
- Use suspension and steering terminology

### **2. VALIDATION OF UNIT 3:**

**Test:** practical evaluation in a real situation allowing the acquisitions obtained during the training course to be evaluated

**Objective of the evaluation:** Evaluate the capacities of the candidate to establish a diagnostic on the wheel alignment using the appropriate information and testing method, and to repair the fault.

**Duration:** 2 hours 30 maximum

#### **Material Necessary:**

Written information about the problem  
Vehicle presenting a malfunction on the wheel alignment.  
All useful technical documents  
Equipped work station  
4-wheel alignment testing equipment

#### **NB**

The evaluation is to be done by at least two instructors competent in the professional domain of automobile maintenance.

## UNIT 3: WHEEL ALIGNMENT

KNOWLEDGE	SKILLS	COMPETENCE
<p><b>K1:</b> <u>General description</u></p> <p>K1.1: Mathematic measures and values            K1.2: Trigonometry            K1.3: Mapping on a axis or a plane            K1.4: 2D and 3D geometry</p> <p><b>K2:</b> <u>Wheel Alignment</u></p> <p>K2.1: Angles of wheel alignment            K2.2: Variation of the angles depending on the movement of the vehicle            K2.3: Testing conditions depending on manufacturers' recommendations            K2.4: Diagnostic angles :                - swivel axis inclination (SAI)                - king pin offset                - camber and caster                - over steer and under steer                - left and right offset                - rear and front offset            K2.5: Geometry of the vehicle            K2.6: Height of the vehicle            K2.7: Dish of the wheel</p>	<p><b>S1:</b> Explain the use of angles</p> <p><b>S2:</b> Put the vehicle into position and condition</p> <p><b>S3:</b> Establish a diagnostic procedure</p> <p><b>S4:</b> Check the geometry of the wheel alignment</p> <p><b>S5:</b> Establish the relationship between the behaviour of the vehicle and the wheel alignment</p> <p><b>S6:</b> Analyse the test report</p> <p><b>S7:</b> Adjust the geometry of the wheel alignment</p> <p><b>S8:</b> Identify the faulty parts</p>	<p><b>C1:</b> Complete a <u>diagnostic and maintenance on the wheel alignment</u></p> <p>C1.1: Complete all of the preliminary test            C1.2: Check the geometry of the wheel alignment            C1.3: Analyse and justify orally the test bench report            C1.4: Adjust the wheel alignment            C1.5: Respect the methods and schedule</p> <p><b>C2:</b> Organise the work <u>respecting health and safety rules</u></p>

## ASSESSMENT OF UNIT 3

### WHEEL ALIGNMENT

<b><u>Moment of assessment :</u></b>	At the end of the training period corresponding to Unit 3
<b><u>Time limit :</u></b>	2 hours 30
<b><u>Nature of assessment :</u></b>	Practical assessment in a real situation

<p><b><u>Objective :</u></b></p> <ul style="list-style-type: none"> <li>- Complete a verification and adjustment of the geometry on the wheel alignment</li> <li>- Adjust the alignment of the wheels</li> </ul> <p><b><u>Context:</u></b></p> <ul style="list-style-type: none"> <li>- A vehicle which has had its angular values modified</li> </ul>	<p><b><u>Material Necessary :</u></b></p> <ul style="list-style-type: none"> <li>- Written information about the problem</li> <li>- A vehicle presenting a malfunction on the wheel alignment</li> <li>- A job sheet</li> <li>- All useful technical documents relative to the vehicle</li> <li>- Equipped work station</li> <li>- 4-wheel alignment testing equipment</li> </ul>
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### UNIT 3

#### DIAGNOSTIC AND MAINTENANCE ON THE WHEEL ALIGNMENT

COMPETENCE	ASSESSMENT CRITERIA	Marks 0, 1, 2, or 3	Coef	Total
<b>Complete all of the preliminary tests</b>	Preliminary testing of the wheel alignment allows possible malfunctions to be detected		2	
<b>Check the geometry of the wheel alignment</b>	The testing equipment is correctly positioned.  The chosen operating procedures are respected		2	
<b>Analyse and justify orally the test bench report</b>	The analysis of the angular values allow the effect on the behaviour of the vehicle on the road to be justified (orally) and the appropriate action to be chosen (replacing damaged parts and/or adjustments to be done)		2	
<b>Adjust the wheel alignment</b>	The adjustments on the wheel alignment are done.  The modifications done on the vehicle conform to the technical specifications of the vehicle in the technical documents  Verification is done to ensure that no other malfunction has appeared		2	
<b>Respect health and safety regulations</b>	The safety of the candidate and the vehicle are respected throughout the evaluation		1	
<b><u>Respect the methods and schedule</u> *</b>	The task is completed within a defined time (2 H 30 maximum).		1	

**\* Special conditions**      **Mark authorised: 0 or 3**

**TOTAL :**

**30**

## MARKING GUIDELINES

### Unit 3 - WHEEL ALIGNMENT

DIAGNOSTIC AND MAINTENANCE ON THE WHEEL ALIGNMENT		
COMPETENCE	ASSESSMENT CRITERIA	Marks
Complete all of the preliminary test	For preliminary testing, in order to obtain correct results, the check conditions are not respected and the possible malfunctions are not validated.	0
	For preliminary testing, in order to obtain correct results, some check conditions are respected but the possible malfunctions are not validated	1
	For preliminary testing, in order to obtain correct results, all check conditions are respected but some possible malfunctions are not validated.	2
	For preliminary testing, in order to obtain correct results, all check conditions are respected and possible malfunctions are validated.	3
Check the geometry of the wheel alignment	The testing equipment is not correctly positioned and the chosen operating procedures are not respected.	0
	The testing equipment is correctly positioned but the chosen operating procedures are not respected.	1
	The testing equipment is correctly positioned and some operating procedures are respected.	2
	The testing equipment is correctly positioned and the chosen operating procedures are respected.	3
Analyse and justify orally the test bench report	The analysis of the angular values is not interpreted.	0
	The analysis of the angular values is interpreted but the appropriate action is not chosen correctly.	1
	The analysis of the angular values is interpreted but some appropriate actions are not chosen correctly.	2
	The analyse test report is interpreted and the appropriate actions are chosen correctly.	3
Adjust the wheel alignment	The adjustments are not done.	0
	The adjustments are done but the technical specifications are not respected	1
	The adjustments are done but some technical specifications are not respected	2
	The adjustments are done and conform to the technical specifications of the vehicle	3
Respect health and safety regulations	Health and safety regulations are not respected	0
	Some health and safety regulations are respected	1
	Most of the health and safety regulations are respected	2
	All the health and safety regulations are respected	3
Respect the methods and schedule	The task is not completed within the time limit of 2 hours 30	0
	The task is completed within the time limit of 2 hours 30	3

## **UNIT 4: ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES**

### **1. CONDITIONS OF ACCESS TO THE UNIT:**

#### **TECHNICAL PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Complete basic maintenance and operation of petrol engine ignition and injection system
- Complete basic maintenance and operation of diesel injection systems
- Use the exhaust-gas measuring devices

#### **METHODOLOGY PRE-REQUISITES:**

**Before starting the training course, the student must be able to :**

- Explain the basic theory of combustion
- Explain the operation of petrol and diesel fuel system and their major components
- Choose the appropriate documents for the job to be done

### **2. VALIDATION OF UNIT 4:**

**Test:** practical evaluation in a real situation allowing the acquisitions obtained during the training course to be evaluated

**Objective of the evaluation :** Evaluate the capacities of the candidate to establish a diagnostic on engine emissions test in petrol engines or diesel engines using the appropriate information and testing methods, and to repair the possible engine running fault.

**Duration:** 2 hours 30 maximum

**Material Necessary:**

Written information about the problem

Vehicle presenting a malfunction on the engine emissions

All useful technical documents

Equipped work station/ multi gas analyzer/ diesel smoke meter/ OBD-diagnostic tool

**NB**

The evaluation is to be done by at least two instructors competent in the professional domain of automobile maintenance.

## UNIT 4: ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES

KNOWLEDGE	SKILLS	COMPETENCE
<p><b><u>K1:</u></b> Exhaust Gases</p> <p>K1.1: Composition K1.2: Air – fuel ratio K1.3: European anti-pollution standards</p> <p><b><u>K2:</u></b> Pollution Control</p> <p>K2.1: Catalytic converter K2.2: Exhaust gas recycling K2.3: Particle filter K2.4: On Board Diagnosis (OBD) K2.5: Diagnostic, maintenance and servicing</p>	<p><b>S1:</b> Perform diagnostic test to enable the assessment of exhaust gas values with diagnostic information.</p> <p><b>S2:</b> Use OBD diagnostic for the evaluation of engine faults.</p> <p><b>S3:</b> Carry out On Board Diagnosis (OBD)</p> <p><b>S4:</b> Read stored diagnostic trouble codes and diagnose the causes of emissions or driveability problems.</p> <p><b>S5:</b> Carry out emissions inspections on diesel and petrol engines (Certificates of Emissions Control)</p>	<p><b><u>C1:</u></b> Diagnose and repair malfunctions of engine emission systems in petrol and diesel engines</p> <p>C1.1: Identify with precision the symptoms of the fault C1.2: Select the hypotheses of the fault depending on the symptoms C1.3: Test the system C1.4: Validate the malfunction and choose the appropriate action to be done C1.5: Respect the methods and schedule</p> <p><b><u>C2:</u></b> Organise the work respecting health and safety rules</p>

## ASSESSMENT OF UNIT 4

### ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES

<b><u>Moment of assessment :</u></b>	At the end of the training period corresponding to Unit 4
<b><u>Time limit :</u></b>	2 hours 30
<b><u>Nature of assessment :</u></b>	Practical assessment in a real situation

<p><b><u>Objective :</u></b></p> <ul style="list-style-type: none"> <li>- Prepare an exhaust-gas measuring device or smoke meter.</li> <li>- Inspect and prepare vehicle for test and obtain exhaust readings.</li> <li>- Interpret readings and determine needed repairs if necessary.</li> </ul> <p>(Test can be done with petrol engine or diesel engine.)</p> <p><b><u>Context :</u></b></p> <ul style="list-style-type: none"> <li>- During the diagnostic, the OBD-diagnostic tool may be used to take parameter readings or actuator test readings or fault readings.</li> <li>- The documents provided must be exhaustive, allowing the student to do a detailed research of information.</li> </ul>	<p><b><u>Material Necessary :</u></b></p> <ul style="list-style-type: none"> <li>- Written information about the problem.</li> <li>- A vehicle presenting emission problems.</li> </ul> <p><b>The malfunction is plausible and allows only a limited number of hypotheses to be given and values to be taken</b></p> <ul style="list-style-type: none"> <li>- A job sheet.</li> <li>- All useful technical documents relative to the vehicle.</li> <li>- Equipped work station.</li> <li>- Multi-gas analyzer or diesel smoke meter.</li> <li>- OBD diagnostic tool.</li> </ul>
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## UNIT 4

### DIAGNOSTIC AND MAINTENANCE OF THE ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES

COMPETENCE	ASSESSMENT CRITERIA	Marks 0, 1, 2, or 3	Coef	Total
<b>Identify with precision the symptoms of the fault</b>	The malfunction is validated. The documents and information used are adapted to : - the vehicle - the system that has the fault.		<b>1</b>	
<b>Select the hypotheses of the fault depending on the symptoms</b>	The hypotheses given are : - plausible - complete - ranked		<b>1</b>	
<b>Test the system</b>	The diagnostic procedure is : - coherent / logical - adapted to the malfunction		<b>1</b>	
	The choice of the reference values used is adapted to the system with the fault The testing equipment chosen allows the measurements to be taken.		<b>1</b>	
<b>Validate the malfunction and choose the appropriate action to be done</b>	The measurements are chosen in relation to the malfunction and the access points. The equipment is used respecting health and safety guidelines.		<b>1</b>	
	The interpretation of the measured values allow the identification of the causes of the fault. The causes of the malfunction are validated and justified.		<b>2</b>	
	The selected procedures allow the vehicle to be repaired. The malfunction is repaired		<b>1</b>	
<b>Organise a work station</b>	The organisation of the work station is practical Environmental, and health and safety rules are respected The work station and vehicle are kept clean throughout the session		<b>1</b>	
<b><u>Respect the methods and schedule</u> *</b>	The task is completed within a defined time (2 H 30 maximum).		<b>1</b>	

\* Special conditions      **Mark authorised: 0 or 3**

<b>TOTAL :</b>	<b>30</b>
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## MARKING GUIDELINES

### Unit 4 - ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES

DIAGNOSTIC AND MAINTENANCE ON ENGINE EMISSIONS IN PETROL AND DIESEL ENGINES		
COMPETENCE	ASSESSMENT CRITERIA	Marks
Identify with precision the symptoms of the fault	The malfunction was not validated and the correct documents were not selected	0
	The malfunction was validated but the correct documents were not selected or the malfunction was not validated but several of the correct documents were selected	1
	The malfunction was validated, the correct documents were identified but some of the information needed was not selected	2
	The malfunction was validated, the correct documents were identified and all of the information needed was selected	3
Select the hypotheses of the fault depending on the symptoms	No hypotheses was given	0
	A few hypotheses were given but were either not plausible or in the wrong order	1
	Most of the hypotheses were given but some were either not plausible or in the wrong order	2
	All the hypotheses were given and were plausible, complete and ranked in the correct order	3
Test the system	No procedure or logic to diagnostic	0
	Several attempts at choosing a diagnostic procedure but without success	1
	Correct diagnosis method chosen, but some procedures are not coherent, logical or adapted to the fault.	2
	Correct diagnosis method chosen and procedures are coherent, logical and adapted to the fault.	3
	No suggestions of reference values given	0
	Correct reference values given but incorrect choice of equipment, or incorrect reference values given but correct choice of equipment	1
	Most of the reference values given are correct with a correct choice of equipment	2
	Correct equipment selected and correct reference values given.	3
Validate the malfunction and choose the appropriate action to be done	The measurements are not taken at accesible points depending on the fault, and no knowledge of the equipment.	0
	The measurements are not taken at accesible points depending on the fault but the equipment is used correctly.	1
	The measurements are taken at accesible points depending on the fault place, but some difficulties in using the equipment.	2
	The correct measurements are taken at accesible points depending on the fault and the equipment is used correctly	3
	Values are not interpreted so no cause identified	0
	Some values are correctly interpreted but no cause identified	1
	Most values are correctly interpreted and the cause found but with hesitation and lack of justification	2
	Values are correctly interpreted	3

	No attempt to repair the vehicle.	0
	Several attempts to repair the vehicle but without success	1
	Vehicle is repaired but it does not conform to specifications.	2
	Vehicle is repaired completely and conforms to specifications	3
Organise a work station	Work station is not functional, dirty and no health and safety regulations are respected.	0
	Work station is functional but dirty and no health and safety regulations are respected.	1
	Work station is functional, clean and most health and safety regulations are respected.	2
	Work station is functional, clean and all health and safety regulations are respected.	3
Respect the methods and schedule	The task is not completed within the time limit of 2 hours 30	0
	The task is completed within a time limit of 2 hours 30	3