

# Diploma in Heavy Vehicle Maintenance and Repair Principles at SCQF Level 7 (4390-23)

February 2016 Version 1.3





## Qualification at a glance

<b>Subject area</b>	Vehicle Maintenance and Repair
<b>City &amp; Guilds number</b>	4390
<b>Age group approved</b>	16+
<b>Entry requirements</b>	There are no entry requirements
<b>Assessment</b>	Graded multiple choice tests Assignments
<b>Fast track</b>	Not available
<b>Support materials</b>	Centre handbook Practical assessment workbook
<b>Registration and certification</b>	See online catalogue/Walled Garden for last dates

<b>Title and level</b>	<b>City &amp; Guilds number</b>	<b>Accreditation number</b>
Diploma in Heavy Vehicle Maintenance and Repair Principles at SCQF Level 7	4390-23	R174 04

<b>Version and date</b>	<b>Change detail</b>	<b>Section</b>
1.1 Dec 2012	General formatting improvement	<b>Various</b>
1.2 Oct 2013	Unit supporting information updated with introductory text	<b>Units</b>



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# 1 Introduction

**This document tells you what you need to do to deliver the qualification:**

Area	Description
Who is the qualification for?	It is for candidates wanting to develop practical skills in, and broaden their understanding of motor vehicle systems. It also gives them the opportunity to learn how to develop others.
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the automotive industry.
Is the qualification part of a framework or initiative?	These qualifications are part of the Scottish Automotive Maintenance and Repair Apprenticeship Frameworks.
What opportunities for progression are there?	Allows candidates to progress into employment or to the following City & Guilds qualifications: <ul style="list-style-type: none"> <li>• 4310-23 SVQ 2 in Heavy Vehicle Maintenance and Repair at SCQF Level 7</li> <li>• ILM management and leadership qualifications.</li> </ul>

## Structure

Qualification	Total credits	Credits from mandatory units	Credits from optional units
Diploma in Heavy Vehicle Maintenance and Repair Principles at SCQF Level 7	<b>79</b>	<b>74</b>	<b>5 (min)</b>
		001, 003, 004, 051, 053, 054, 206, 207, 208, 255, 257, 258, 263, 406, 456	006 and 056 or 008 and 058 or 211 and 261 or 213 or 221 and 271 or 231 and 281

Full qualification certificates will be awarded to successful candidates on completion of the required combinations of units. Candidates completing one or more units, rather than the full qualification, will receive a Certificate of Unit Credit (CUC).

<b>City &amp; Guilds unit</b>	<b>Unit title</b>	<b>Credit value</b>
<b>Mandatory</b>		
001	Skills in health, safety and good housekeeping in the automotive environment	7
003	Skills in supporting job roles in the automotive work environment	5
004	Skills in materials, fabrication, tools and measuring devices used in the automotive environment	7
051	Knowledge of health, safety and good housekeeping in the automotive environment	3
053	Knowledge of support for job roles in the automotive work environment	3
054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	4
206	Skills required to inspect heavy vehicles to comply with legal requirements	2
207	Skills in diagnosing and rectifying heavy vehicle engine faults	5
208	Skills in diagnosing and rectifying heavy vehicle chassis system faults	5
255	Knowledge of inspecting heavy vehicles	4
257	Knowledge of diagnosis and rectification of heavy vehicle engine faults	6
258	Knowledge of diagnosis and rectification of heavy vehicle chassis faults	6
263	Knowledge of diagnosis and rectification of heavy transmission and driveline faults	6
406	Skills in diagnosing and rectifying vehicle auxiliary electrical faults	5
456	Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults	6
<b>Optional</b>		
006	Skills in how to make learning possible through demonstrations and instruction	5
008	Skills to identify and agree motor vehicle customer service needs	5
056	Knowledge of how to make learning possible through demonstrations and instruction	5
058	Knowledge of how to identify and agree motor vehicle customer service needs	5
211	Skills required to overhaul heavy vehicle engine mechanical units	6
213	Skills in diagnosing and rectifying heavy vehicle transmission and driveline faults	5

<b>City &amp; Guilds unit</b>	<b>Unit title</b>	<b>Credit value</b>
221	Skills required to overhaul heavy vehicle transmission units	6
231	Skills required to overhaul heavy vehicle steering and suspension units	6
261	Knowledge of overhauling heavy vehicle engine mechanical units	5
271	Knowledge of overhauling heavy vehicle transmission units	4
281	Knowledge of overhauling heavy vehicle steering and suspension units	4



## 2 Centre requirements

### Approval

Centres already approved to offer the Level 3 Certificate/ Diploma in Maintenance and Repair - Heavy Vehicle (4101-52) will be automatically approved to register and certificate candidates on the 4390-23 (unless the centre is already subject to sanctions).

For all other cases, centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information. Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

### Resource requirements

#### Physical resources and site agreements

Centres must have access to sufficient equipment in the college, training centre or workplace to ensure candidates have the opportunity to cover all of the practical activities.

#### Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

#### Assessor and verifiers

While the Assessor/Verifier (A/V) units are valued as qualifications for centre staff, they are not currently a requirement for this qualification.

#### Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.



## **Candidate entry requirements**

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualifications successfully.

Please note that for funding purposes, candidates should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

## **Age restrictions**

City & Guilds cannot accept any registrations for candidates under 16 as this qualification not approved for under 16s.



### 3 Delivering the qualification

#### Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs
- support and guidance they may need when working towards their qualification
- any units they have already completed, or credit they have accumulated which is relevant to the qualification
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

#### Support materials

The following resources are available for this qualification:

<b>Description</b>	<b>How to access</b>
Centre handbook	<a href="http://www.cityandguilds.com/automotive">www.cityandguilds.com/automotive</a>
Practical assessment workbook	<a href="http://www.cityandguilds.com/automotive">www.cityandguilds.com/automotive</a>



## 4 Assessment

City & Guilds has written the following assessments to use with this qualification:

- Assignments (practical assessment workbooks) comprising of practical tasks and knowledge based questions to cover all learning outcomes graded Pass only.
- Online multiple choice tests graded Pass, Merit, Distinction.

Assignments can be downloaded from **[www.cityandguilds.com/automotive](http://www.cityandguilds.com/automotive)**. These assessments are carried out in centres and must be completed to current industry standards and practice.

### Time constraints

The following must be applied to the assessment of this qualification:

- Candidates must complete their assessments within their registration period.

### Test specifications

Summary test specifications for all 4390 online tests can be found in the *Automotive online test specifications* document, downloadable from the 4390 website.

City & Guilds unit	Unit title	Credit value	Assessment method
001	Skills in health, safety and good housekeeping in the automotive environment	7	Assignment
003	Skills in supporting job roles in the automotive work environment	5	Assignment
004	Skills in materials, fabrication, tools and measuring devices used in the automotive environment	7	Assignment
006	Skills in how to make learning possible through demonstrations and instruction	5	Assignment
008	Skills to identify and agree motor vehicle customer service needs	5	Assignment
051	Knowledge of health, safety and good housekeeping in the automotive environment	3	Assignment
053	Knowledge of support for job roles in the automotive work environment	3	Assignment
054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	4	Assignment

<b>City &amp; Guilds unit</b>	<b>Unit title</b>	<b>Credit value</b>	<b>Assessment method</b>
056	Knowledge of how to make learning possible through demonstrations and instruction	5	Assignment
058	Knowledge of how to identify and agree motor vehicle customer service needs	5	Assignment
206	Skills required to inspect heavy vehicles to comply with legal requirements	2	Assignment
207	Skills in diagnosing and rectifying heavy vehicle engine faults	5	Assignment
208	Skills in diagnosing and rectifying heavy vehicle chassis system faults	5	Assignment
211	Skills required to overhaul heavy vehicle engine mechanical units	6	Assignment
213	Skills in diagnosing and rectifying heavy vehicle transmission and driveline faults	5	Assignment
221	Skills required to overhaul heavy vehicle transmission units	6	Assignment
231	Skills required to overhaul heavy vehicle steering and suspension units	6	Assignment
255	Knowledge of inspecting heavy vehicles	4	Multiple choice test
257	Knowledge of diagnosis and rectification of heavy vehicle engine faults	6	Multiple choice test
258	Knowledge of diagnosis and rectification of heavy vehicle chassis faults	6	Multiple choice test
261	Knowledge of overhauling heavy vehicle engine mechanical units	5	Multiple choice test
263	Knowledge of diagnosis and rectification of heavy transmission and driveline faults	6	Multiple choice test
271	Knowledge of overhauling heavy vehicle transmission units	4	Multiple choice test
281	Knowledge of overhauling heavy vehicle steering and suspension units	4	Multiple choice test
406	Skills in diagnosing and rectifying vehicle auxiliary electrical faults	5	Multiple choice test
456	Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults	6	Multiple choice test



## 5 Units

### Structure of units

- These units each have the following:
- City & Guilds reference number
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

## Unit 001

# Skills in health, safety and good housekeeping in the automotive environment

<b>Level:</b>	<b>5</b>
<b>Credit value:</b>	7
<b>Relationship to NOS:</b>	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environment and G2 Reduce Risks to Health and Safety in the Motor Vehicle Environment.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	<p>This unit will enable the learner to develop the skills required to:</p> <ul style="list-style-type: none"><li>• carry out day to day work area cleaning, clearing away, dealing with spillages and disposal of waste, used materials and debris.</li><li>• identify hazards and risks in the automotive environment and complying with relevant legislation and good practice.</li><li>• work safely at all times within the automotive environment, both as an individual and with others.</li></ul>

<b>Learning outcome</b>	<b>The learner will:</b>
1.	be able to use correct personal and vehicle protection within the automotive work environment
<b>Assessment criteria</b>	
The learner can:	
1.1	select and use personal protective equipment throughout activities. To include appropriate protection of: <ul style="list-style-type: none"><li>a. eyes</li><li>b. ears</li><li>c. head</li><li>d. skin</li><li>e. feet</li><li>f. hands</li><li>g. lungs</li></ul>
1.2	select and use vehicle protective equipment throughout all activities.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	be able to carry out effective housekeeping practices in the automotive work environment
<b>Assessment criteria</b>	
The learner can:	
2.1	select and use cleaning equipment which is of the right type and suitable for the task
2.2	use utilities and appropriate consumables, avoiding waste
2.3	use materials and equipment to carry out cleaning and maintenance duties in allocated work areas, following automotive work environment policies, schedules and manufacturers' instructions
2.4	perform housekeeping activities safely and in a way which minimizes inconvenience to customers and staff.
2.5	keep the work area clean and free from debris and waste materials
2.6	keep tools and equipment fit for purpose by regular cleaning and keeping tidy
2.7	dispose of used cleaning agents, waste materials and debris to comply with legal and workplace requirements.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	be able to recognise and deal with dangers in order to work safely within the automotive workplace
<b>Assessment criteria</b>	
The learner can:	
3.1	name and locate the responsible persons for health and safety in their relevant workplace
3.2	identify and report working practices and hazards which could be harmful to themselves or others
3.3	carry out safe working practices whilst working with equipment, materials and products in the automotive environment
3.4	rectify health and safety risks encountered at work, within the scope and capability of their job role.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	be able to conduct themselves responsibly
<b>Assessment criteria</b>	
The learner can:	
4.1	show personal conduct in the workplace which does not endanger the health and safety of themselves or others
4.2	display suitable personal presentation at work which ensures the health and safety of themselves and others at work.

## Unit 003

## Skills in supporting job roles in the automotive work environment

<b>Level:</b>	<b>6</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to G3 Maintain Working Relationships in the Motor Vehicle Environment.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit will help the learner develop the skills required to keep good working relationships with all colleagues and customers in the automotive work environment by using effective communication and support.

<b>Learning outcome</b>	<b>The learner will:</b>
1.	be able to work effectively within the organisational structure of the automotive work environment
<b>Assessment criteria</b>	
The learner can	
1.1	respond promptly and willingly to requests for assistance from customers and colleagues
1.2	refer customers and colleagues to the correct person should requests fall outside their responsibility and capability.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	be able to obtain and use information in order to support their job role within the automotive work environment
<b>Assessment criteria</b>	
The learner can	
2.1	select and use legal and technical information, in an automotive work environment.



<b>Learning outcome</b>	<b>The learner will:</b>
3.	be able to communicate with and support colleagues and customers effectively within the automotive work environment
<b>Assessment criteria</b>	
The learner can	
3.1	use methods of communication with customers and colleagues which meet their needs
3.2	give customers and colleagues accurate information
3.3	make requests for assistance from or to customers and colleagues clearly and courteously.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	be able to develop and keep good working relationships in the automotive work environment
<b>Assessment criteria</b>	
The learner can	
4.1	contribute to team work by initiating ideas and co-operating with customers and colleagues
4.2	treat customers and colleagues in a way which shows respect for their views and opinions
4.3	make and keep achievable commitments to customers and colleagues
4.4	inform colleagues promptly of anything likely to affect their own work.

## Unit 004

# Skills in materials, fabrication, tools and measuring devices in the automotive environment

<b>Level:</b>	<b>5</b>
<b>Credit value:</b>	7
<b>Relationship to NOS:</b>	This unit is linked to G4 Use of hand tools and equipment in motor vehicle engineering.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	<p>This unit helps the learner to develop the skills required for:</p> <ul style="list-style-type: none"><li>• the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment</li><li>• the correct preparation and use of common work environment equipment</li><li>• the correct selection and fabrication of materials used when modifying and repairing</li><li>• the correct application of automotive engineering fabrication and fitting principles.</li></ul>

<b>Learning outcome</b>	<b>The learner will:</b>
1. be able to select, maintain and use hand tools and measuring devices in the automotive environment	
<b>Assessment criteria</b>	
The learner can:	
1.1	select, maintain and use suitable hand tools safely when fabricating and fitting in the automotive workplace
1.2	select, maintain and use suitable measuring devices safely when fabricating and fitting in the automotive environment
1.3	select, maintain and use suitable PPE for fabrication, repair and fitting in the automotive environment
1.4	select, maintain and use suitable electrical measuring tools safely when repairing vehicles and components.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	be able to prepare and use common workshop equipment
<b>Assessment criteria</b>	
The learner can:	
2.1	use suitably maintained workshop equipment safely
2.2	use correct interpretation of 'safe working load' on lifting and supporting equipment
2.3	report any faulty or damaged tools and equipment to the relevant persons clearly and promptly
2.4	store work tools and equipment in a safe manner which permits ease of access and identification for use.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	be able to select materials when fabricating, modifying and repairing vehicles and fitting components
<b>Assessment criteria</b>	
The learner can:	
3.1	select and use appropriate materials whilst constructing, fitting, modifying or repairing vehicles and components.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	be able to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components
<b>Assessment criteria</b>	
The learner can:	
4.1	use correct procedures when: <ul style="list-style-type: none"> <li>a. filing</li> <li>b. tapping threads</li> <li>c. cutting plastics and metals</li> <li>d. drilling plastics and metals</li> <li>e. fitting</li> </ul>
4.2	use appropriate techniques when fabricating, repairing and modifying vehicles and components
4.3	select and use: <ul style="list-style-type: none"> <li>a. gaskets</li> <li>b. seals</li> <li>c. sealants</li> <li>d. fittings and fasteners</li> </ul>
4.4	apply modification and repair techniques to automotive electrical circuits
4.5	select and use locking, fixing and fastening devices.

## Unit 006

# Skills in how to make learning possible through demonstrations and instruction

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	<b>5</b>
<b>Relationship to NOS:</b>	This unit is linked to G6 Enable Learning through Demonstration and Instruction.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit covers the skills needed in order to carry out demonstrations and instruction which will help the learner to learn. It includes demonstrating equipment, showing skills, giving instruction, deciding when to use demonstration or instruction, potential of technology based learning, checking on learners' progress and giving feedback.

<b>Learning outcome</b>	<b>The learner will:</b>
1.	be able to demonstrate skills and methods to learners
<b>Assessment criteria</b>	
The learner can:	
1.1	perform demonstrations based on an analysis of the skills needed and the order in which they must be learned
1.2	perform demonstrations that are accurate and realistic
1.3	perform structured demonstrations so that the learner can get the most out of it
1.4	perform demonstrations whilst encouraging learners to ask questions and get explanation at appropriate stages in the demonstration
1.5	provide positive feedback to learners whilst they are being given the opportunity to practise the skills that have been demonstrated
1.6	perform additional demonstrations of skills being taught to reinforce learning
1.7	perform demonstrations in a safe environment which also allows learners to see clearly
1.8	respond to the needs of the learners during demonstrations
1.9	reduce distractions and disruptions as much as possible.

Learning outcome	The learner will:
2. be able to instruct learners	
<b>Assessment criteria</b>	
<p>The learner can:</p> <ul style="list-style-type: none"> <li>2.1 implement instruction which is matched to the needs of learners</li> <li>2.2 use identified learning outcomes which can be achieved through instruction</li> <li>2.3 perform instruction, ensuring that the manner, level and speed of the instruction encourages learners to take part</li> <li>2.4 perform instruction whilst regularly checking that the learners understand and adapt instruction as appropriate</li> <li>2.5 give learners positive feedback on the learning experience and the outcomes achieved</li> <li>2.6 carry out a review with the learners to identify anything that prevented learning and adapt instruction as appropriate.</li> </ul>	

## Unit 008

## Skills to identify and agree motor vehicle customer service needs

<b>Level:</b>	<b>6</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to G8 Identify and agree the motor vehicle customer needs.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit is about the skills required to: gain information from customers on their perceived needs; give advice and information and agree a course of action; contract for the agreed work and complete all necessary records and instructions.

<b>Learning outcome</b>	<b>The learner will:</b>
1.	be able to obtain relevant information from the customer
<b>Assessment criteria</b>	
The learner can:	
1.1	obtain and interpret sufficient, relevant information, from the customer to make an assessment of their needs
1.2	clarify customer and vehicle needs by referring to vehicle data and operating procedures.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	be able to provide relevant information to the customer
<b>Assessment criteria</b>	
The learner can:	
2.1	provide customers with accurate, current and relevant advice and information, in a form that the customer will understand
2.2	demonstrate techniques which encourage customers to ask questions and seek clarification during conversation.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	be able to agree work undertaken with the customer
<b>Assessment criteria</b>	
The learner can:	
3.1	summarise and record work agreed with the customer, before accepting the vehicle
3.2	implement confirmation of the agreement by ensuring customer understanding.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	be able to ensure recording systems are implemented correctly
<b>Assessment criteria</b>	
The learner can:	
4.1	use recording systems which are accurate and complete, in the required format and signed by the customer where necessary
4.2	perform the next stage in the process by passing on completed records to the correct person promptly
4.3	demonstrate correct procedures for customer approval where the contracted agreement is likely to be exceeded.

## Unit 051

# Knowledge of health, safety and good housekeeping in the automotive environment

<b>Level:</b>	<b>5</b>
<b>Credit value:</b>	3
<b>Relationship to NOS:</b>	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environment and G2 Reduce Risks to Health and Safety in the Motor Vehicle Environment.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	<p>This unit enables the learner to develop an understanding of:</p> <ul style="list-style-type: none"><li>• routine maintenance and cleaning of the automotive environment and using resources economically</li><li>• health and safety legislation and duties of everyone in the motor vehicle environment. It will provide an appreciation of significant risks in the automotive environment and how to identify and deal with them. Once completed the learner will be able to identify hazards and evaluate and reduce risk.</li></ul>

<b>Learning outcome</b>	<b>The learner will:</b>
1.	understand the correct personal and vehicle protective equipment to be used within the automotive environment
<b>Assessment criteria</b>	
The learner can	
1.1	explain the importance of wearing the types of PPE required for a range automotive repair activities
1.2	identify vehicle protective equipment for a range of repair activities
1.3	describe vehicle and personal safety considerations when working at the roadside.



<b>Learning outcome</b>	<b>The learner will:</b>
2.	understand effective housekeeping practices in the automotive environment
<b>Assessment criteria</b>	
The learner can	
2.1	describe why the automotive environment should be properly cleaned and maintained
2.2	describe requirements and systems which may be put in place to ensure a clean automotive environment.
2.3	describe how to minimise waste when using utilities and consumables
2.4	state the procedures and precautions necessary when cleaning and maintaining an automotive environment
2.5	describe the selection and use of cleaning equipment when dealing with general cleaning, spillages and leaks in the automotive environment
2.6	describe procedures for correct disposal of waste materials from an automotive environment
2.7	describe procedures for starting and ending the working day which ensure effective housekeeping practices are followed.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	understand key health and safety requirements relevant to the automotive environment
<b>Assessment criteria</b>	
The learner can	
3.1	list the main legislation relating to automotive environment health and safety
3.2	describe the general legal duties of employers and employees required by current health and safety legislation
3.3	describe key, current health and safety requirements relating to the automotive environment
3.4	describe why workplace policies and procedures relating to health and safety are important.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	understand about hazards and potential risks relevant to the automotive environment
<b>Assessment criteria</b>	
The learner can	
4.1	identify key hazards and risks in an automotive environment
4.2	describe policies and procedures for reporting hazards, risks, health and safety matters in the automotive environment
4.3	state precautions and procedures which need to be taken when working with vehicles, associated materials, tools and equipment
4.4	identify fire extinguishers in common use and which types of fire they should be used on
4.5	identify key warning signs and their characteristics that are found in the vehicle repair environment
4.6	state the meaning of common product warning labels used in an automotive environment.

<b>Learning outcome</b>	<b>The learner will:</b>
5.	understand personal responsibilities
<b>Assessment criteria</b>	
The learner can	
5.1	explain the importance of personal conduct in maintaining the health and safety of the individual and others
5.2	explain the importance of personal presentation in maintaining health safety and welfare.

## Unit 051

# Knowledge of health, safety and good housekeeping in the automotive environment

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **Economic use of resources**

- a. Consumable materials eg grease, oils, split pins, locking and fastening devices etc.

### **Requirement to maintain work area effectively**

- a. Cleaning tools and equipment to maximise workplace efficiency.
- b. Requirement to carry out the housekeeping activities safely and in a way that minimises inconvenience to customers and staff.
- c. Risks involved when using solvents and detergents.
- d. Advantages of good housekeeping.

### **Spillages, leaks and waste materials**

- a. Relevance of safe systems of work to the storage and disposal of waste materials.
- b. Requirement to store and dispose of waste, used materials and debris correctly.
- c. Safe disposal of special / hazardous waste materials.
- d. Advantages of recycling waste materials.
- e. Dealing with spillages and leaks.

### **Basic legislative requirements**

- a. Provision and Use of Work Equipment Regulations 1992
- b. Power Presses Regulations 1992
- c. Pressure Systems and Transportable Gas Containers Regulations 1989
- d. Electricity at Work Regulations 1989
- e. Noise at Work Regulations 1989
- f. Manual Handling Operations Regulations 1992
- g. Health and Safety (Display Screen Equipment) Regulations 1992
- h. Abrasive Wheel Regulations
- i. Safe Working Loads
- j. Working at Height Regulations.

### **Routine maintenance of the workplace**

- a. Trainee's personal responsibilities and limits of their authority with regard to work equipment.

- b. Risk assessment of the workplace activities and work equipment.
- c. Workplace person responsible for training and maintenance of workplace equipment.
- d. When and why safety equipment must be used.
- e. Location of safety equipment.
- f. Particular hazards associated with their work area and equipment.
- g. Prohibited areas.
- h. Plant and machinery that trainees must not use or operate.
- i. Why and how faults on unsafe equipment should be reported.
- j. Storing tools, equipment and products safely and appropriately.
- k. Using the correct PPE.
- l. Following manufacturers' recommendations.
- m. Location of routine maintenance information e.g. electrical safety check log.

### **Legislation relevant to Health and Safety**

- a. HASAWA
- b. COSHH
- c. EPA
- d. Manual Handling Operations Regulations 1992
- e. PPE Regulations 1992.

### **General regulations to include an awareness of:**

- a. Health and Safety (Display Screen Equipment) Regulations 1992
- b. Health and Safety (First Aid) Regulations 1981
- c. Health and Safety (Safety Signs and Signals) Regulations 1996
- d. Health and Safety (Consultation with Employees) Regulations 1996
- e. Employers Liability (Compulsory Insurance) Act 1969 and Regulations 1998
- f. Confined Spaces Regulations 1997
- g. Noise at Work Regulations 1989
- h. Electricity at Work Regulations 1989
- i. Electricity (Safety) Regulations 1994
- j. Fire Precautions Act 1971
- k. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985
- l. Pressure Systems Safety Regulations 2000
- m. Waste Management 1991
- n. Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002
- o. Control of Asbestos at Work Regulations 2002.

### **Legislative duties**

- a. The purpose of a Health and Safety Policy.
- b. The relevance of the Health and Safety Executive.
- c. The relevance of an initial induction to Health and Safety requirements at your workplace.
- d. General employee responsibilities under the HASAWA and the consequences of non-compliance.
- e. General employer responsibilities under the HASAWA and the consequences of non-compliance.

- f. The limits of authority with regard to Health and Safety within a personal job role.
- g. Workplace procedure to be followed to report Health and Safety matters.

**Precautions to be taken when working with vehicles, workshop materials, tools and equipment including electrical safety, pneumatics and hydraulics**

- a. Accessing and interpreting safety information.
- b. Seeking advice when needed.
- c. Seeking assistance when required.
- d. Reporting of unsafe equipment.
- e. Storing tools, equipment and products safely and appropriately.
- f. Using the correct PPE.
- g. Following manufacturers' recommendations.
- h. Following application procedures e.g. hazardous substances.
- i. The correct selection and use of extraction equipment.

**PPE to include:**

- a. Typical maintenance procedures for PPE equipment to include:
  - i. typical maintenance log
  - ii. cleaning procedures
  - iii. filter maintenance
  - iv. variation in glove types
  - v. air quality checks.
- b. Choice and fitting procedures for masks and air breathing equipment
- c. Typical workplace processes which would require the use of PPE to include:
  - i. welding
  - ii. sanding and grinding
  - iii. filling
  - iv. panel removal and replacement
  - v. drilling
  - vi. cutting
  - vii. chiselling
  - viii. removal of broken glass
  - ix. removal of rubber seals from fire damaged vehicles
  - x. removal of hypodermic needles
  - xi. servicing activities
  - xii. roadside recovery.
- d. Unserviceable PPE.
- e. PPE required for a range automotive repair activities. To include appropriate protection of:
  - i. eyes
  - ii. ears
  - iii. head
  - iv. skin
  - v. feet
  - vi. hands
  - vii. lungs.

**Fire and extinguishers**

- a. Classification of fire types.
- b. Using a fire extinguisher effectively.
- c. Types of extinguishers:
  - i. foam
  - ii. dry powder
  - iii. CO2
  - iv. water
  - v. fire blanket.

**Action to be taken in the event of a fire to include:**

- a. the procedure as:
  - i. raise the alarm
  - ii. fight fire only if appropriate
  - iii. evacuate building
  - iv. call for assistance.

**Product warning labels to include:**

- a. reasons for placing warning labels on containers.
- b. warning labels in common use:
  - i. toxic
  - ii. corrosive
  - iii. poisonous
  - iv. harmful
  - v. irritant
  - vi. flammable
  - vii. explosive.

**Warning signs and notices**

- a. Colours used for warning signs:
  - i. red
  - ii. blue
  - iii. green.
- b. Shapes and meaning of warning signs:
  - i. round
  - ii. triangular
  - iii. square.
- c. The meaning of prohibitive warning signs in common use.
- d. The meaning of mandatory warning signs in common use.
- e. The meaning of warning notices in common use.
- f. General design of safe place warning signs.

**Hazards and risks to include:**

- a. The difference between a risk and a hazard.
- b. Potential risks resulting from:
  - i. the use and maintenance of machinery or equipment
  - ii. the use of materials or substances
  - iii. accidental breakages and spillages
  - iv. unsafe behaviour
  - v. working practices that do not conform to laid down policies
  - vi. environmental factors

- vii. personal presentation
- viii. unauthorised personnel, customers, contractors etc entering the work premises
- ix. working by the roadside
- x. vehicle recovery.
- c. The employee's responsibilities in identifying and reporting risks within their working environment.
- d. The method of reporting risks that is outside own limits of authority.
- e. Potential causes of:
  - i. fire
  - ii. explosion
  - iii. noise
  - iv. harmful fumes
  - v. slips
  - vi. trips
  - vii. falling objects
  - viii. accidents whilst dealing with broken down vehicles.

### **Personal responsibilities**

- a. The purpose of workplace polices and procedures on:
  - i. the use of safe working methods and equipment
  - ii. the safe use of hazardous substances
  - iii. smoking, eating , drinking and drugs
  - iv. emergency procedures
  - v. personal appearance.
- b. The importance of personal appearance in the control of health and safety.

### **Action to be taken in the event of colleagues suffering accidents**

- a. The typical sequence of events following the discovery of an accident such as:
  - i. make the area safe
  - ii. remove hazards if appropriate i.e. switch off power
  - iii. administer minor first aid
  - iv. take appropriate action to re-assure the injured party
  - v. raise the alarm
  - vi. get help
  - vii. report on the accident.
- b. Typical examples of first aid which can be administered by persons at the scene of an accident:
  - i. check for consciousness
  - ii. stem bleeding
  - iii. keep the injured person's airways free
  - iv. place in the recovery position if injured person is unconscious
  - v. issue plasters for minor cuts
  - vi. action to prevent shock i.e. keep the injured party warm
  - vii. administer water for minor burns or chemical injuries
  - viii. wash eyes with water to remove dust or ingress of chemicals (battery acid)
  - ix. need to seek professional help for serious injuries.
- c. Examples of bad practice which may result in further injury such as:

- i. moving the injured party
- ii. removing foreign objects from wounds or eyes
- iii. inducing vomiting
- iv. straightening deformed limbs.



## Unit 053

## Knowledge of support for job roles in the automotive work environment

<b>Level:</b>	<b>6</b>
<b>Credit value:</b>	3
<b>Relationship to NOS:</b>	This unit is linked to G3 Maintain Working Relationships in the Motor Vehicle Environment.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements
<b>Aim:</b>	This unit enables the learner to develop an understanding of how to keep good working relationships with all colleagues in the automotive work environment by using effective communication and support skills.

<b>Learning outcome</b>	<b>The learner will:</b>
1. understand key organisational structures, functions and roles within the automotive work environment	
<b>Assessment criteria</b>	
The learner can:	
1.1 identify the purpose of the different sections of a typical automotive work environment	
1.2 explain organisational structures and lines of communication within the automotive work environment	
1.3 explain levels of responsibility within specific job roles in an automotive workplace. To include:	
a. trainee	
b. skilled technician	
c. supervisor	
d. manager.	

<b>Learning outcome</b>	<b>The learner will:</b>
2.	understand the importance of obtaining, interpreting and using information in order to support their job role within the automotive work environment
<b>Assessment criteria</b>	
The learner can:	
2.1	explain the importance of different sources of information in an automotive work environment
2.2	explain how to find, interpret and use relevant sources of information
2.3	describe the main legal requirements relating to the vehicle, including road safety requirements
2.4	explain the importance of working to recognised procedures and processes
2.5	explain when replacement units and components must meet the manufacturers' original equipment specification
2.6	explain the purpose of how to use identification codes.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	understand the importance of different types of communication within the automotive work environment
<b>Assessment criteria</b>	
The learner can:	
3.1	explain where different methods of communication would be used within the automotive environment
3.2	explain the factors which can determine their choice of communication
3.3	explain how the communication of information can change with the target audience to include informed and uninformed people.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	understand communication requirements when carrying out vehicle repairs in the automotive work environment
<b>Assessment criteria</b>	
The learner can:	
4.1	explain how to report using written and verbal communication
4.2	explain the importance of documenting information relating to work carried out in the automotive environment
4.3	explain the importance of working to agreed timescales.

<b>Learning outcome</b>	<b>The learner will:</b>
5. understand how to develop good working relationships with colleagues and customers in the automotive workplace	
<b>Assessment criteria</b>	
The learner can:	
5.1 describe how to develop positive working relationships with colleagues and customers	
5.2 explain the importance of developing positive working relationships	
5.3 explain the importance of accepting other peoples' views and opinions	
5.4 explain the importance of making and honouring realistic commitments to colleagues and customers.	

## **Unit 053                    Knowledge of support for job roles in the automotive work environment**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

#### **The structure of a typical vehicle repair business**

- a. How these areas relate to each other within the business:
  - i. body shop
  - ii. vehicle repair workshop
  - iii. paint shop
  - iv. valeting
  - v. vehicle parts store
  - vi. main office
  - vii. vehicle sales
  - viii. reception.

#### **Sources of information**

- a. Other staff.
- b. Manuals.
- c. Parts lists.
- d. Computer software and the internet.
- e. Manufacturer.
- f. Diagnostic equipment.

#### **Communication requirements when carrying out vehicle repairs**

- a. Locating and using correct documentation and information for:
  - i. recording vehicle maintenance and repairs
  - ii. vehicle specifications
  - iii. component specifications
  - iv. oil and fluid specifications
  - v. equipment and tools
  - vi. identification codes.
- b. Procedures for:
  - i. referral of problems
  - ii. reporting delays
  - iii. additional work identified during repair or maintenance
  - iv. keeping others informed of progress.
- c. Methods of communication:
  - i. verbal
  - ii. signs and notices

- iii. memos
  - iv. telephone
  - v. electronic mail
  - vi. vehicle job card
  - vii. notice boards
  - viii. SMS text messaging
  - ix. letters.
- d. Organisational and customer requirements:
- i. importance of time scales to customer and organization
  - ii. relationship between time and costs
  - iii. meaning of profit.
- e. Choice of communication
- i. distance
  - ii. location
  - iii. job responsibility.
- f. Importance of maintaining positive working relationships:
- i. morale
  - ii. productivity
  - iii. company image
  - iv. customer relationships
  - v. colleagues.

## Unit 054

# Knowledge of materials, fabrication, tools and measuring devices in the automotive environment

<b>Level:</b>	<b>5</b>
<b>Credit value:</b>	4
<b>Relationship to NOS:</b>	This unit is linked to G4 Use of hand tools and equipment in Motor Vehicle Engineering.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	<p>This unit enables the learner to develop an understanding of:</p> <ul style="list-style-type: none"><li>• the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment</li><li>• the correct preparation and use of common work environment equipment</li><li>• the correct selection and fabrication of materials used when modifying and repairing</li><li>• the correct application of automotive engineering fabrication and fitting principles.</li></ul>

<b>Learning outcome</b>	<b>The learner will:</b>
1. understand how to select, use and care for hand tools and measuring devices in the automotive environment	
<b>Assessment criteria</b>	
The learner can:	
1.1	identify and explain the use of common types of hand tools used for fabricating and fitting in the automotive environment
1.2	identify and explain the use of common measuring devices used for fabrication and fitting in the automotive environment
1.3	describe, within the scope of their responsibilities, how to select, prepare and maintain hand tools, measuring devices and PPE used for fabrication, repair and fitting in the automotive environment
1.4	state the limitations of common hand tools and measuring devices used for fabricating, repair and fitting in the automotive workplace
1.5	explain how common hand tools and measuring devices used for fabricating, repair and fitting in the automotive environment should be stored and maintained

1.6	identify common electrical measuring tools used in the repair of vehicles and components
1.7	explain the preparation and safe and correct use of common electrical tools when measuring voltage, current and resistance.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	understand how to prepare and use common workshop equipment
<b>Assessment criteria</b>	
The learner can:	
2.1	describe the preparation and safe use of workshop equipment
2.2	explain the term: safe working load.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	understand how to select materials when fabricating, modifying and repairing vehicles and fitting components
<b>Assessment criteria</b>	
The learner can:	
3.1	describe the properties, application and limitations of ferrous and non-ferrous metals, including their safe use
3.2	describe the properties, application and limitations of common non-metallic materials, including their safe use
3.3	define common terms relating to the properties of materials.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	understand how to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components
<b>Assessment criteria</b>	
The learner can:	
4.1	describe how to tap threads, file, cut and drill plastics and metals when modifying or repairing vehicles
4.2	describe how to measure, mark out, shape and join materials when fabricating
4.3	describe the selection and fitting procedures of the following: <ul style="list-style-type: none"> <li>a. gaskets and seals</li> <li>b. sealants and adhesives</li> <li>c. fittings and fasteners</li> <li>d. electrical circuit components</li> </ul>
4.4	identify locking, fastening and fixing devices
4.5	state the importance of current operating specifications for limits, fits and tolerances in the automotive environment.

## **Unit 054                    Knowledge of materials, fabrication, tools and measuring devices in the automotive environment**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

**Common types of hand tools used for fabricating and fitting in the automotive workplace** to include:

- a. files
- b. hacksaws and snips
- c. hammers
- d. screwdrivers
- e. pliers
- f. spanners
- g. sockets
- h. punches
- i. types of drill and drill bits
- j. taps and dies
- k. stud removers
- l. marking out tools.

**Common measuring devices used for fabrication and fitting** in the automotive environment. To include:

- a. rule or tape
- b. callipers
- c. feeler gauge
- d. volume measures
- e. micrometer
- f. dial gauges
- g. torque wrenches
- h. depth gauges.

**Common electrical measuring tools** used in the repair of vehicles and components. To include:

- a. ammeter
- b. voltmeter
- c. ohmmeter
- d. multi-meter.

**Common electrical terms when measuring:**



- a. voltage
- b. current
- c. resistance.

**Workshop equipment (including appropriate PPE) to include:**

- a. hydraulic jacks
- b. axle stands
- c. pillar drills
- d. air tools
- e. vehicle lifts
- f. cranes
- g. hoists
- h. electrical power tools.

**The properties, application and limitations to include safe use of ferrous and non-ferrous metals used when constructing, modifying and repairing vehicles and components.** Materials to include:

- a. carbon steels
- b. alloy steels
- c. cast iron
- d. aluminium alloys
- e. brass
- f. copper
- g. lead.

**The properties, application and limitations to include safe use of non-metallic materials used when constructing, modifying and repairing vehicles and components.** Materials to include:

- a. glass
- b. plastics
- c. Kevlar
- d. rubber.

**Terms relating to the properties of materials to include:**

- a. hardness
- b. toughness
- c. ductility
- d. elasticity
- e. tenacity
- f. malleability
- g. plasticity.

## Unit 056

# Knowledge of how to make learning possible through demonstrations and instruction

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	<b>5</b>
<b>Relationship to NOS:</b>	This unit is linked to G6 Enable Learning through Demonstration and Instruction.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of how to carry out demonstrations and instruction which will help the learner to learn. It includes demonstrating equipment, showing skills, giving instruction, deciding when to use demonstration or instruction, potential of technology based learning, checking on learners' progress and giving feedback.

<b>Learning outcome</b>	<b>The learner will:</b>
1.	understand the nature and role of demonstrations and instruction
<b>Assessment criteria</b>	
The learner can:	
1.1	classify the separate areas of demonstrations which encourage learning
1.2	identify which types of learning are best achieved and supported through demonstrations
1.3	explain how to identify and use different learning opportunities
1.4	explain how to structure demonstrations and instruction sessions
1.5	explain how to choose from a range of demonstration techniques.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	understand the principles and concepts of demonstration and instruction
<b>Assessment criteria</b>	
The learner can:	
2.1	describe how to put learners at ease and encourage them to take part
2.2	justify the choice between demonstration and instruction as a learning method
2.3	explain how to identify individual learning needs
2.4	clarify which factors are likely to prevent learning and how to overcome them
2.5	explain how to check learners' understanding and progress
2.6	explain how to choose and prepare appropriate materials
2.7	explain the separate areas of instructional techniques which encourage learning
2.8	describe which types of learning are best achieved and supported through instruction.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	understand the external factors influencing human resource development
<b>Assessment criteria</b>	
The learner can:	
3.1	explain how to make sure everybody acts in line with health, safety and environmental protection, legislation and best practice
3.2	analyse developments in technology based learning and new ways of delivery.

## **Unit 056                    Knowledge of how to make learning possible through demonstrations and instruction**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

**Separate areas of demonstration which encourage learning** to include:

- a. Demonstration is particularly applicable to learning manual skills.
- b. Learning to do something usually involves:
  - i. purpose – the aim or objective
  - ii. procedure - the most effective way of completing the task
  - iii. practice – all skills require practice to improve
- c. Practical tasks are more quickly learnt through demonstration.
- d. Emphasis is required to body movements when demonstrating.
- e. The demonstrator should encourage learners to ask questions.
- f. Emphasis should be placed upon key points whilst demonstrating.
- g. Any demonstration should ensure that all safety aspects are covered.

**Types of learning which are best achieved and supported through demonstrations** to include:

- a. Types of learning:
  - i. psychomotor – measurement of manual skill performance
  - ii. cognitive – learning involving thought processes
  - iii. affective – demonstration of feelings, emotions or attitudes.
- b. Demonstration - involves learning to do something (Psychomotor Domain).
- c. Combination of instruction and practical demonstrations are very effective means of learning practical skills.

**How to structure demonstration and instruction sessions** to include:

- a. Before the demonstration and/or instruction ensure that the following good practice is recognised:
  - i. identify key points
  - ii. relate theoretical underpinning knowledge to key points
  - iii. rehearse to ensure that all equipment is working
  - iv. ensure all students can see even small equipment and processes
  - v. time the demonstration
  - vi. consider how to make students participate
  - vii. consider how to emphasise safe working practices.

- b. During the demonstration and/or instruction good practice is to:
  - i. give a clear introduction
  - ii. identify any tools/equipment
  - iii. determine the current audience level of knowledge
  - iv. complete the demonstration correctly (do not show how not to do it)
  - v. stress key points and show links between them
  - vi. monitor safety aspects
  - vii. check learner understanding.
- c. After the demonstration (if possible)
  - i. enable the audience to practise the techniques
  - ii. provide feedback on their performance.

### **How to identify individual learning needs**

- a. Diagnose the learning needs of your audience to include:
  - i. what competencies they already have
  - ii. what experience they have of the subject area
  - iii. what competencies they need to achieve
  - iv. what demonstration techniques are best suited to their needs
  - v. how you will assess their needs have been met.

### **What factors are likely to prevent learning, to include:**

- a. language barriers
- b. physical barriers
- c. specialist knowledge
- d. pace of learning
- e. method of delivery
- f. environmental factors
- g. teaching styles
- h. dyslexia.

### **How to check learner's understanding and progress**

- a. Questionnaires.
- b. Verbal questioning.
- c. Observation.
- d. Assessment.
- e. Role play.
- f. Projects/assignments.
- g. Multi-choice questions.
- h. Simulation.
- i. Tests.

### **How to organise information and prepare materials**

- a. Identify the course aim.
- b. Identify the subject aim.
- c. Identify the lesson aim.
- d. Complete a lesson plan - plan the teaching.
- e. Identify a series of 'cues' to be used during the lesson.
- f. Logically organise the information.

- g. Use suitable resources and equipment to maximise learning opportunities.
- h. Assess the learner's progress and understanding.

### **Instructional techniques**

- a. Types of instructional techniques to include:
  - i. lectures
  - ii. handouts
  - iii. team teaching
  - iv. peer teaching
  - v. discussion – individual, group and peer
  - vi. question and answer
  - vii. multimedia
  - viii. seminars
  - ix. case studies
  - x. project/assignments.

### **Environmental factors that affect learning**

- a. Environmental factors that should be considered before demonstration/instruction to include:
  - i. loud noises
  - ii. bright colours
  - iii. bright lights
  - iv. strong smells
  - v. atmosphere
  - vi. temperature
  - vii. classroom seating
  - viii. classroom layout
  - ix. bright lights.

### **Health and safety factors that affect learning**

- a. Health and safety factors that should be considered before demonstration/instruction to include:
  - i. assessment of risk and hazards
  - ii. condition of electrical/electronic equipment
  - iii. position of cables and wires
  - iv. safety of equipment used in demonstration/instruction
  - v. condition of classroom equipment/furniture/structure
  - vi. suitable protective clothing/equipment.

### **Analysis of demonstration/instruction**

- a. Analysis of demonstration/instruction to include:
  - i. feedback from students
  - ii. feedback from colleagues
  - iii. organisational quality assessment
  - iv. feedback from external organisations
  - v. awarding body requirements.

### **Developments in learning**

To include:

- a. multimedia based materials

- b. web based materials
- c. interactive materials.

**How to choose and prepare appropriate materials.**

To include:

- a. putting information in order
- b. deciding whether the language used is appropriate
- c. type of material i.e. paper and technology based etc.

## Unit 058

## Knowledge of how to identify and agree motor vehicle customer service needs

<b>Level:</b>	<b>6</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to G8 Identify and agree the motor vehicle customer needs.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of how to gain: information from customers on their perceived needs; give advice and information and agree a course of action; contract for the agreed work and complete all necessary records and instructions.

<b>Learning outcome</b>	<b>The learner will:</b>
1. understand legislative and organisational requirements and procedures	
<b>Assessment criteria</b>	
The learner can:	
1.1	describe the fundamental legal requirements of current consumer legislation and the consequences of their own actions in respect of this legislation
1.2	describe the content and limitations of company and product warranties for the vehicles dealt with by their company
1.3	explain the limits of their own authority for accepting vehicles
1.4	explain the importance of keeping customers informed of progress
1.5	describe their workplace requirements for the completion of records
1.6	explain how to complete and process all the necessary documentation.



<b>Learning outcome</b>	<b>The learner will:</b>
	2. understand how to communicate and care for customers
<b>Assessment criteria</b>	
The learner can:	
2.1 explain how to communicate effectively with customers	
2.2 describe how to adapt their language when explaining technical matters to non-technical customers	
2.3 explain how to use effective questioning techniques	
2.4 describe how to care for customers and achieve customer satisfaction.	

<b>Learning outcome</b>	<b>The learner will:</b>
	3. understand company products and services
<b>Assessment criteria</b>	
The learner can:	
3.1 describe the range of options available to resolve vehicle problems	
3.2 describe the range and type of services offered by their company	
3.3 explain the effect of resource availability upon the receipt of customer vehicles and the completion work	
3.4 explain how to access costing and work completion time information.	

## **Unit 058                    Knowledge of how to identify and agree motor vehicle customer service needs**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

#### **Organisational requirements**

- a. Explain the organisation's terms and conditions applicable to the acceptance of customer vehicles.
- b. Explain the content and limitations of vehicle and component warranties for the vehicles dealt with by your organisation.
- c. Detail what, if any, limits there are to the authority for accepting vehicles.
- d. Detail why it is important to keep customers advised of progress and how this is achieved within the organisation.
- e. Detail the organisation's procedures for the completion and processing of documentation and records, including payment methods and obtaining customer signatures as applicable.

#### **Principles of customer communication and care**

- a. First impressions.
- b. Listening skills – 80:20 ratio.
- c. Eye contact and smiling.
- d. Showing interest and concern.
- e. Questioning techniques and customer qualification.
- f. Giving clear non-technical explanations.
- g. Confirming understanding (statement/question technique, reflective summary).
- h. Written communication – purpose, content, presentation and style.
- i. Providing a high quality service – fulfilling (ideally exceeding) customer expectations within agreed time frames.
- j. Obtaining customer feedback and corrective actions when dissatisfaction expressed.
- k. Dealing with complaints.

#### **Company products and services**

- a. Service standards:
  - i. national
  - ii. manufacturer
  - iii. organisational.
- b. The range and type of services offered by the organisation:
  - i. diagnostic
  - ii. servicing

- iii. repair
- iv. warranty
- v. MOT testing
- vi. fitment of accessories/enhancements
- vii. internal.
- c. The courses of action available to resolve customer problems:
  - i. the extent and nature of the work to be undertaken
  - ii. the terms and conditions of acceptance
  - iii. the cost
  - iv. the timescale
  - v. required payment methods.
- d. The effect of resource availability upon the receipt of customer vehicles and the completion of work:
  - i. levels and availability of equipment
  - ii. levels and availability of technicians
  - iii. workshop loading systems.
- e. How to access costing and work completion time information:
  - i. manuals
  - ii. computer based.

### **Vehicle information systems, servicing and repair requirements**

- a. Accessing technical data including diagnostics.
- b. Servicing to manufacturer requirements/standards.
- c. Repair/operating procedures.
- d. MOT standards/requirements.
- e. Quality controls – interim and final.
- f. Requirements for cleanliness of vehicle on return to customer.
- g. Handover procedures.

### **Consumer legislation** to include:

- a. consumer protection
- b. sale of goods
- c. data protection
- d. product liability
- e. health and safety
- f. discrimination.

## Unit 206

## Skills required to inspect heavy vehicles to comply with legal requirements

<b>Level:</b>	<b>6</b>
<b>Credit value:</b>	2
<b>Relationship to NOS:</b>	This unit is linked to HV06 Inspect Commercial Motor Vehicles.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills required to carry out a range of heavy vehicle legal compliance inspections using a variety of methods.

<b>Learning outcome</b>	The learner will:
	1. be able to work safely when carrying out heavy vehicle inspections
<b>Assessment criteria</b>	
	The learner can:
	1.1 use suitable personal protective equipment and vehicle coverings when carrying out heavy vehicle inspections to comply with legal requirements
	1.2 work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
	2. be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
	The learner can:
	2.1 select suitable sources of technical information to support heavy vehicle inspection activities including:
	a. vehicle technical data
	b. inspection procedures
	c. legal requirements
	d. heavy vehicle inspection manual
	2.2 use technical information to support heavy vehicle inspection activities.

<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for carrying out a range of inspections on heavy vehicle systems including: <ul style="list-style-type: none"> <li>a. pre-MOT inspection</li> <li>b. scheduled safety inspections (PMI)</li> </ul>	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the tools and equipment in the way specified by manufacturers when carrying out a range of inspections on heavy vehicle systems.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out heavy vehicle inspections	
<b>Assessment criteria</b>	
The learner can:	
4.1 carry out heavy vehicle inspections, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> <li>a. the manufacturer's approved inspection methods</li> <li>b. recognised researched inspection methods</li> <li>c. health and safety requirements</li> <li>d. workplace procedures</li> </ul>	
4.2 ensure the inspected heavy vehicle complies to the vehicle operating specification and any legal requirements	
4.3 use suitable testing methods to evaluate the performance of the inspected systems.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 207

## Skills in diagnosing and rectifying heavy vehicle engine faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to HV07 Diagnose and Rectify Motor Vehicle Engine and Component Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills required to diagnose and rectify heavy vehicle engine mechanical, electrical, hydraulic and fluid systems faults.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when carrying out heavy vehicle engine diagnostic and rectification activities
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when carrying out heavy vehicle engine diagnosis and rectification
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support heavy vehicle diagnostic and rectification activities including: a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of heavy vehicle engine system faults.

<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for diagnostic and rectification activities	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the equipment required safely throughout all heavy vehicle engine diagnostic and rectification activities.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out heavy vehicle engine diagnosis, rectification and test activities	
<b>Assessment criteria</b>	
The learner can:	
4.1 use diagnostic methods that are relevant to the symptoms presented	
4.2 evaluate their assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately	
4.3 carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> <li>a. manufacturers' instructions</li> <li>b. recognised researched repair methods</li> <li>c. workplace procedures</li> <li>d. health and safety requirements</li> </ul>	
4.4 ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements	
4.5 adjust components and units correctly to ensure that they operate to meet system requirements	
4.6 use testing methods that are suitable for assessing the performance of the system rectified	
4.7 ensure the heavy vehicle engine system rectified performs to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 208

## Skills in diagnosing and rectifying heavy vehicle chassis system faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to HV08 Diagnose and Rectify Motor Vehicle Chassis System Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to demonstrate they can diagnose and rectify heavy vehicle braking steering and suspension systems faults. It also covers the evaluation of performance of the replaced or repaired units and systems.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when carrying out heavy vehicle chassis diagnostic and rectification activities
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when working on heavy vehicle chassis units
1.2	work in a way which minimises the risk of damage or injury to the motorcycle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support heavy vehicle diagnostic and rectification activities including:
2.2	vehicle technical data
2.3	diagnostic test procedures
2.4	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of heavy vehicle chassis system faults.



<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for diagnostic and rectification activities	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the equipment required safely throughout all heavy vehicle chassis diagnostic and rectification activities.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out heavy vehicle chassis diagnosis, rectification and test activities	
<b>Assessment criteria</b>	
The learner can:	
4.1 use diagnostic methods that are relevant to the symptoms presented	
4.2 evaluate their assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately	
4.3 carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> <li>a. manufacturers' instructions</li> <li>b. recognised researched repair methods</li> <li>c. workplace procedures</li> <li>d. health and safety requirements</li> </ul>	
4.4 ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements	
4.5 adjust components and units correctly to ensure that they operate to meet system requirements	
4.6 use testing methods that are suitable for assessing the performance of the system rectified	
4.7 ensure the heavy vehicle chassis system rectified performs to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 211

## Skills required to overhaul heavy vehicle engine mechanical units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills required to overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when overhauling heavy vehicle engine mechanical units
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling heavy vehicle engine units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of heavy vehicle engine units including: <ul style="list-style-type: none"> <li>a. vehicle technical data</li> <li>b. overhauling procedures</li> <li>c. legal requirements</li> </ul>
2.2	use technical information to support the overhauling of heavy vehicle engine units.

<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for overhauling heavy vehicle engine units	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the tools and equipment in the way specified by manufacturers to overhaul heavy vehicle engine units.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out the overhauling of heavy vehicle engine mechanical units	
<b>Assessment criteria</b>	
The learner can:	
4.1 carry out all overhauling of heavy vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> <li>a. the manufacturer's approved overhauling methods</li> <li>b. recognised researched repair methods</li> <li>c. health and safety requirements</li> <li>d. workplace procedures</li> </ul>	
4.2 ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul	
4.3 inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform	
4.4 use testing methods that comply with the manufacturer's requirements	
4.5 adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements	
4.6 ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 213

# Skills in diagnosing and rectifying heavy vehicle transmission and driveline faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to HV13 Diagnose and Rectify Motor Vehicle Transmission and Driveline Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills to diagnose and rectify heavy vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive unit faults. It also covers the evaluation of performance of the replaced or repaired units and systems.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when carrying out heavy vehicle transmission and driveline diagnostic and rectification activities
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout when working on heavy vehicle transmission and driveline systems and components
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support heavy vehicle diagnostic and rectification activities including: a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of heavy vehicle transmission and driveline system faults.

<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for diagnostic and rectification activities	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the equipment required safely throughout all heavy vehicle transmission and driveline diagnostic and rectification activities.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out heavy vehicle transmission and driveline diagnosis, rectification and test activities	
<b>Assessment criteria</b>	
The learner can:	
4.1 use diagnostic methods that are relevant to the symptoms presented	
4.2 evaluate their assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately	
4.3 carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> <li>a. manufacturers' instructions</li> <li>b. recognised researched repair methods</li> <li>c. workplace procedures</li> <li>d. health and safety requirements</li> </ul>	
4.4 ensure all repaired and replaced components and units conform to the vehicle operating specification and any legal requirements	
4.5 adjust components and units to ensure that they operate to meet system requirements	
4.6 use testing methods that are suitable for assessing the performance of the system rectified	
4.7 ensure the heavy vehicle transmission and driveline system rectified performs to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 221

## Skills required to overhaul heavy vehicle transmission units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills to overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when overhauling heavy vehicle transmission units
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling heavy vehicle transmission units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of heavy vehicle transmission units including: a. vehicle technical data b. overhauling procedures c. legal requirements
2.2	use technical information to support the overhauling of heavy vehicle transmission units.

<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for the overhaul of heavy vehicle transmission systems	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the tools and equipment in the way specified by manufacturers to overhaul heavy vehicle transmission units.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out the overhauling of heavy vehicle transmission units	
<b>Assessment criteria</b>	
The learner can:	
4.1 carry out all overhauling of heavy vehicle transmission units, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> <li>a. the manufacturer's approved overhauling methods</li> <li>b. recognised researched repair methods</li> <li>c. health and safety requirements.</li> <li>d. workplace procedures</li> </ul>	
4.2 ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul	
4.3 inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform	
4.4 use testing methods that comply with the manufacturer's requirements	
4.5 adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements	
4.6 ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 231

## Skills required to overhaul heavy vehicle steering and suspension units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit allows the learner to develop the skills to overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

<b>Learning outcome</b>	The learner will:
1.	be able to work safely when overhauling heavy vehicle steering and suspension units
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling heavy vehicle steering and suspension units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	The learner will:
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of heavy vehicle steering and suspension units including: a. vehicle technical data b. overhauling procedures c. legal requirements
2.2	use technical information to support the overhauling of heavy vehicle steering and suspension units.



<b>Learning outcome</b>	The learner will:
3. be able to use appropriate tools and equipment	
<b>Assessment criteria</b>	
The learner can:	
3.1 select the appropriate tools and equipment necessary for overhauling heavy vehicle steering and suspension units	
3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements	
3.3 use the tools and equipment in the way specified by manufacturers for overhauling heavy vehicle steering and suspension units.	

<b>Learning outcome</b>	The learner will:
4. be able to carry out the overhauling of heavy vehicle steering and suspension units	
<b>Assessment criteria</b>	
The learner can:	
4.1 carry out all overhauling of heavy vehicle steering and suspension units, adhering to the specifications and tolerances for the vehicle and following:	
a. the manufacturer's approved overhauling methods	
b. recognised researched repair methods	
c. health and safety requirements.	
d. workplace procedures	
4.2 ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul	
4.3 inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform	
4.4 use testing methods that comply with the manufacturer's requirements	
4.5 adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements	
4.6 ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.	

<b>Learning outcome</b>	The learner will:
5. be able to record information and make suitable recommendations	
<b>Assessment criteria</b>	
The learner can:	
5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required	
5.2 make suitable and justifiable recommendations for cost effective repairs	
5.3 record and report any additional faults noticed during the course of their work promptly in the format required.	

## Unit 255

## Knowledge of inspecting heavy vehicles

<b>Level:</b>	<b>5</b>
<b>Credit value:</b>	4
<b>Relationship to NOS:</b>	This unit is linked to HV05 Conduct Pre and Post Work Motor Vehicle Inspections and HV06 Inspect Commercial Motor Vehicles.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of carrying out a range of inspections on heavy vehicles using a variety of equipment and testing methods.

<b>Learning outcome</b>	The learner will:
1.	understand how to carry out inspections on heavy vehicles using prescribed methods
<b>Assessment criteria</b>	
The learner can:	
1.1	explain the difference between the various prescribed heavy vehicle inspection methods to include: <ul style="list-style-type: none"><li>a. pre-delivery and pre-purchase</li><li>b. pre MOT</li><li>c. daily vehicle checks</li><li>d. scheduled safety inspection</li><li>e. pre and post rental inspection</li></ul>
1.2	identify the different systems to be inspected when using the prescribed inspection methods
1.3	identify the procedures involved to carry out the systematic inspection of the prescribed inspection methods on heavy vehicles
1.4	identify conformity of vehicle systems and condition on heavy vehicle inspections
1.5	compare test and inspection results against heavy vehicle specification and legal requirements
1.6	explain how to record and complete the inspection results in the format required
1.7	identify the recommendations that can be made based on results of the heavy vehicle inspections
1.8	explain the implications of failing to carry out heavy vehicle inspection activities correctly

- 1.9 explain the implications of signing workplace documentation and vehicle records
- 1.10 explain the procedure for reporting damage to heavy vehicle components and units outside normal inspection items.

# Unit 255 Knowledge of inspecting heavy vehicles

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **Different types of heavy vehicle inspection**

- a. Types of inspection:
  - i. pre-purchase / pre-delivery
  - ii. pre-MOT inspection
  - iii. scheduled safety inspections
  - iv. daily vehicle checks
  - v. pre-rental / post rental inspections.

### **Vehicle inspections and maintenance records**

- a. The purpose and scope of the different types of vehicle inspection.
- b. Vehicle inspection techniques for different types of inspection including:
  - i. systematic inspections
  - ii. aural
  - iii. visual and functional assessments on engine
  - iv. engine systems
  - v. chassis systems
  - vi. wheels and tyres
  - vii. transmission and driveline system
  - viii. electrical and electronic systems
  - ix. exterior vehicle body
  - x. vehicle interior
- c. The procedure for inspection of the vehicle for damage, corrosion, fluid leaks, wear, security, mounting security and condition to include:
  - i. engines and engine systems
  - ii. chassis systems
  - iii. brakes
  - iv. transmission and driveline
  - v. steering
  - vi. suspension
  - vii. wheels
  - viii. tyres
  - ix. body panels (structural and non-structural)
  - x. electrical and electronic systems and components
  - xi. vehicle seating and vehicle interior
  - xii. instruments.
- d. Preparation and use of appropriate inspection equipment and tools including:
  - i. emission testing
  - ii. brake testing
  - iii. headlamp alignment
  - iv. wheel alignment

- v. torque setting
- vi. specialist diagnostic equipment
- vii. tyre tread depth gauges.
- e. Inspection procedures following inspection checklists.
- f. Checking conformity to manufacturer's specifications and legal requirements:
  - i. workshop manuals
  - ii. heavy goods vehicle inspection manual.
- g. Testing and operation of vehicle systems and vehicle condition including workshop based tests and road tests.
- h. The completion and maintenance of:
  - i. documentation
  - ii. defect reports
  - iii. inspection records
  - iv. job cards
  - v. vehicle records.
- i. Make recommendations based on results of vehicle inspections.
- j. The implications of not carrying out vehicle inspections correctly including:
  - i. legal aspects (impact on Operator Licence)
  - ii. safety aspects
  - iii. financial aspects
  - iv. customer retention
  - v. customer relationships.

**The need for vehicle protection prior to carrying out vehicle inspection**

- a. Protection relating to:
  - i. vehicle body panels
  - ii. paint surfaces
  - iii. seats
  - iv. carpets and floor mats.
- b. Checks to be made following maintenance and repair:
  - i. vehicle body panels
  - ii. paint surfaces
  - iii. seats
  - iv. carpets and floor mats.

## Unit 257

## Knowledge of diagnosis and rectification of heavy vehicle engine faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to HV07 Diagnose and Rectify Commercial Motor Vehicle Engine and Component Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of diagnosis and rectification of engine mechanical, electrical, hydraulic and fluid systems.

<b>Learning outcome</b>	The learner will:
1.	understand how heavy vehicle engine systems operate
<b>Assessment criteria</b>	
The learner can:	
1.1	explain the construction and operation of heavy vehicle engine systems
1.2	explain the interaction between electrical, electronic and mechanical components within heavy vehicle engine systems
1.3	explain how electrical systems interlink and interact, including multiplexing and fibre optics
1.4	compare heavy vehicle engine system components and assemblies against alternatives to identify differences in construction and operation
1.5	explain the engineering principles that are related to heavy vehicle engine systems
	a. volumetric efficiency
	b. flame travel, pre ignition and detonation
	c. fuel properties
	d. composition of carbon fuels
	e. combustion process
	f. legal requirements for exhaust emissions.

<b>Learning outcome</b>	The learner will:
2.	understand how to diagnose and rectify faults in heavy vehicle engine systems
<b>Assessment criteria</b>	
The learner can:	
2.1	describe how to analyse symptoms and causes of faults found in heavy vehicle engine systems
2.2	explain systematic diagnostic techniques used in identifying engine system faults
2.3	explain how to examine, measure and make suitable adjustments to the components
2.4	explain how to carry out the diagnosis and rectification activities in order to correct the faults in the heavy vehicle engine systems
2.5	explain how to select, prepare and use diagnostic and rectification equipment for heavy vehicle engine systems
2.6	explain how to evaluate and interpret test results found in diagnosing heavy vehicle engine system faults against vehicle manufacturer specifications and settings
2.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.

# **Unit 257                    Knowledge of diagnosis and rectification of heavy vehicle engine faults**

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **The construction and operation of engine systems**

- a. Electronic diesel control systems (EDC).
- b. Common rail fuel systems.
- c. Unit injection fuel systems.
- d. Engine management.
- e. Pressure charged induction systems.
- f. Exhaust emission reduction systems.
- g. Mechanical fuel injection systems.
- h. Valve mechanisms.
- i. Heating, ventilation and cooling.

### **Common rail and unit injection systems**

- a. The operation and construction of common rail and unit injection systems including:
  - i. types of air flow sensor
  - ii. fuel supply system
  - iii. fuel pump
  - iv. filter
  - v. fuel regulator
  - vi. injectors
  - vii. main injection
  - viii. pre injection
  - ix. post injection
  - x. electronic control unit (ECU)
  - xi. injector pulse width
  - xii. sensors.
- b. The operation of each system under various operating conditions including:
  - i. cold starting
  - ii. warm up
  - iii. hot starting
  - iv. acceleration
  - v. deceleration
  - vi. cruising
  - vii. full load.

### **Engine management**

- a. The function and purpose of engine management systems.
- b. The difference between analogue, digital, programmable and non-programmable systems.



- c. Open loop and closed loop control, types of input and output devices.
- d. The function and operation of digital components and systems.
- e. The operation of engine management systems under various conditions.

### **Pressure charged induction systems**

- a. The meaning of volumetric efficiency; explain the effect of volumetric efficiency on engine performance, torque and power.
- b. The methods used to improve volumetric efficiency:
  - i. variable geometry turbo-charging
  - ii. turbo-charging
  - iii. supercharging
  - iv. aftercoolers (intercooler)
- c. The operation of turbo-chargers and the purpose of:
  - i. turbo-charging
  - ii. supercharging
  - iii. aftercoolers (intercooler)
  - iv. waste gates
  - v. exhaust gas recirculation
- d. Advantages and disadvantages of pressure charging induction systems.

### **Terms associated with combustion**

- a. Phases of combustion, flame travel, pre-injection and diesel knock.
- b. Fuel properties:
  - i. cetane rating
  - ii. flash point
  - iii. fire point
  - iv. volatility
  - v. composition of petrol and diesel fuels
  - vi. hydro-carbon content.
- c. Composition of carbon fuels:
  - i. % hydrogen and carbon
  - ii. composition of air.
- d. The by-products of combustion for compression ignition engines:
  - i. carbon monoxide
  - ii. carbon dioxide
  - iii. oxides of nitrogen
  - iv. particulates.

### **Diesel exhaust emission control**

- a. Describe the legal requirements for exhaust emissions:
  - i. MOT requirements
  - ii. EU regulations.
- b. The operation and construction of Selective Catalytic Reduction systems.
- c. The operation and construction of Exhaust Gas Recirculation systems.

### **Assessment, repair and restoration of mechanical engine components**

- a. How engine mechanical components are assessed and measured for wear and serviceability:
  - i. cylinder bores and liners
  - ii. pistons
  - iii. cylinder heads
  - iv. crankshaft journals
  - v. valve faces

- vi. valve guides
  - vii. valve seats
  - viii. camshafts.
- b. The methods used for the repair and restoration of engine components.

### **Symptoms and faults in engine mechanical systems and components**

- a. symptoms and faults related to:
- i. engine mechanical components
  - ii. injection systems
  - iii. fuel supply systems
  - iv. engine management system
  - v. pressure charged induction system
  - vi. exhaust emission reduction systems
  - vii. valve mechanisms
  - viii. heating and ventilation
  - ix. cooling
  - x. worn cylinders
  - xi. cylinder liners
  - xii. pistons
  - xiii. piston rings
  - xiv. crankshaft
  - xv. camshaft
  - xvi. bearings
  - xvii. cylinder head and gasket
  - xviii. valves
  - xix. valve seats and valve guides
  - xx. camshaft drives
  - xxi. lubrication system and components
  - xxii. oil pump
  - xxiii. relief valve
  - xxiv. filter
  - xxv. turbo-charger
  - xxvi. supercharger.

### **Diagnosis of faults in engine mechanical systems and components**

- a. Interpret information for:
- i. diagnostic tests
  - ii. manufacturer's vehicle and equipment specifications
  - iii. use of equipment
  - iv. testing procedures
  - v. test plans
  - vi. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Systematic assessment, testing and inspection of engine components and systems including:
- i. mechanical system and component condition
  - ii. engine balance
  - iii. power balance
  - iv. performance and operation
  - v. wear
  - vi. run out
  - vii. alignment.
- d. Use of appropriate tools and equipment including:
- i. compression gauges

- ii. leakage testers
- iii. cylinder balance tester
- iv. pressure gauges
- v. micrometers
- vi. vernier gauges.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. The procedures for dismantling components and systems and the use of appropriate equipment and procedures.
- h. Assess, examine and measure components including:
  - i. settings
  - ii. values
  - iii. condition
  - iv. wear and performance of components and systems.
- i. Make suitable adjustments to components including:
  - i. settings
  - ii. input and output values
  - iii. voltages
  - iv. current consumption
  - v. resistance
  - vi. output patterns with oscilloscope
  - vii. pressures
  - viii. condition
  - ix. wear and performance.
- j. Probable faults
  - i. malfunctions
  - ii. incorrect settings
  - iii. wear.
- k. Rectification or replacement procedures.
- l. Evaluate operation of components and systems following diagnosis and repair to confirm system performance.

### **Faults and symptoms in electronic diesel injection systems**

- a. Diesel injection system failures or malfunctions including:
  - i. cold or hot starting problems
  - ii. poor performance
  - iii. exhaust emissions
  - iv. high fuel consumption
  - v. erratic running power
  - vi. unstable idle speed.

### **Faults and symptoms in engine management systems**

- a. Engine management system failure or malfunctions including:
  - i. misfiring
  - ii. cold or hot starting problems
  - iii. poor performance
  - iv. diesel knock
  - v. exhaust emission levels
  - vi. fuel consumption
  - vii. low power
  - viii. unstable idle speed.

### **Diagnosis of faults in electronic diesel injection and engine management systems**

- a. Locate and interpret information for:

- i. diagnostic tests
  - ii. manufacturer's vehicle and equipment specifications
  - iii. use of equipment
  - iv. testing procedures
  - v. test plans
  - vi. fault codes
  - vii. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Conduct systematic assessment, testing of engine systems including:
  - i. component condition and performance
  - ii. component settings
  - iii. component values
  - iv. electrical and electronic values
  - v. system performance and operation
  - vi. use of appropriate tools and equipment including gauges
  - vii. multi-meter
  - viii. breakout box
  - ix. oscilloscope
  - x. diagnostic tester
  - xi. manufacturer's dedicated equipment
  - xii. exhaust gas analyser
  - xiii. pressure gauges.
- d. Evaluate and interpret test results from diagnostic testing.
- e. Compare test result, values and fault codes with vehicle manufacturer's specifications and settings.
- f. The procedures for dismantling, components and systems using appropriate equipment.
- g. Assess, examine and measure components including:
  - i. settings
  - ii. input and output values
  - iii. voltages
  - iv. current consumption
  - v. resistance
  - vi. output patterns with oscilloscope
  - vii. condition
  - viii. wear and performance of components and systems.
- h. Identify probable faults and indications of:
  - i. faults
  - ii. malfunctions
  - iii. incorrect settings
  - iv. wear
  - v. values
  - vi. inputs and outputs
  - vii. fault codes.
- i. Rectification or replacement procedures.
- j. Evaluation and the operation of components and systems following diagnosis and repair to confirm system performance.

### **Faults and symptoms in vehicle comfort systems**

- a. System failure, malfunction or ineffectiveness of internal heating system, air conditioning system or climatic control system including:
  - i. leaks
  - ii. abnormal noise
  - iii. ineffective operation
  - iv. failure to operate
  - v. control faults

vi. inadequate operation.

### **Diagnosis of faults in vehicle comfort systems**

- a. Locate and interpret information for:
  - i. diagnostic tests
  - ii. manufacturer's vehicle and equipment specifications
  - iii. use of equipment
  - iv. testing procedures
  - v. test plans
  - vi. fault codes
  - vii. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Conduct systematic assessment and testing of comfort systems including:
  - i. component condition and performance
  - ii. component settings
  - iii. component values
  - iv. electrical and electronic values
  - v. system performance and operation
  - vi. drive belts
  - vii. controls
  - viii. compressors
  - ix. condensers
  - x. receivers
  - xi. dryers
  - xii. connections
  - xiii. valve
  - xiv. hoses
  - xv. thermostats and refrigerants
  - xvi. sensors
  - xvii. speed controls
  - xviii. control systems
  - xix. servomotors.
- d. Use of appropriate tools and equipment including:
  - i. pressure gauges
  - ii. multi-meter
  - iii. breakout box
  - iv. oscilloscope
  - v. diagnostic tester
  - vi. manufacturer's dedicated equipment
  - vii. flow meter.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result, values and fault codes with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. How to assess, examine and measure components including: settings, input and output values, voltages, current consumption, resistance, output patterns with oscilloscope, pressures, condition, wear and performance of components and systems.
- i. Identification of probable faults and indications of faults, malfunctions, incorrect settings, wear, values, inputs and outputs, fault codes, pressures and leaks.
- j. Rectification or replacement procedures.
- k. Evaluation and operation of components and systems following diagnosis and repair to confirm system performance.

## Unit 258

## Knowledge of diagnosis and rectification of heavy vehicle chassis faults

<b>Level:</b>	7
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to HV08 Diagnose and Rectify Commercial Motor Vehicle Chassis System Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of diagnosis and rectification of braking steering and suspension systems. It also covers advanced heavy vehicle chassis systems and the evaluation of their performance.

<b>Learning outcome</b>	The learner will:
	1. understand how the heavy vehicle chassis systems operate
<b>Assessment criteria</b>	
	The learner can:
	1.1 explain the construction and operation of heavy vehicle chassis systems
	1.2 explain the interaction between electrical, electronic and mechanical components within heavy vehicle chassis systems
	1.3 explain how heavy vehicle chassis electrical systems interlink and interact, including multiplexing
	1.4 compare heavy vehicle chassis system components and assemblies against alternatives to identify differences in construction and operation
	1.5 explain the engineering principles that are related to heavy vehicle chassis systems
	a. inertia force, mass and acceleration
	b. laws of friction
	c. statics (springs and torsion bars)
	d. hydraulic machines.

<b>Learning outcome</b>	The learner will:
2.	understand how to diagnose and rectify faults in heavy vehicle chassis systems
<b>Assessment criteria</b>	
The learner can:	
2.1	explain symptoms and causes of faults found in heavy vehicle chassis systems
2.2	explain systematic diagnostic techniques used in identifying chassis system faults
2.3	explain how to examine, measure and make suitable adjustments to the components
2.4	explain how to carry out the diagnosis and rectification activities in order to correct the faults in the heavy vehicle chassis systems
2.5	explain how to select, prepare and use diagnostic and rectification equipment for heavy vehicle chassis systems
2.6	explain how to evaluate and interpret test results found in diagnosing heavy vehicle chassis system faults against vehicle manufacturer specifications and settings
2.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.

# Unit 258 Knowledge of diagnosis and rectification of heavy vehicle chassis faults

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **Chassis system operation:**

- a. Construction and operation of heavy vehicle chassis systems to include:
  - i. Anti-lock Braking Systems (ABS)
  - ii. Electronic Braking Systems (EBS)
  - iii. Electronic Brake-force Distribution (EBD)
  - iv. Anti-Slip Regulation / Traction Control (ASR)
  - v. Electronic Stability Programme (ESP)
  - vi. Rear wheel steer
  - vii. power assisted steering
  - viii. Electronically Controlled Air Suspension (ECAS)
- b. The Engineering principle relating to heavy vehicle chassis systems:
  - i. inertia force, mass and acceleration
  - ii. laws of friction
  - iii. statics (springs and torsion bars)
  - iv. hydraulic and pneumatic principles
- c. Make suitable adjustments to components including:
  - i. settings
  - ii. input and output values
  - iii. voltages
  - iv. current consumption
  - v. resistance
  - vi. output patterns with oscilloscope
  - vii. pressures
  - viii. condition
  - ix. wear and performance

### **Electrical and electronic principles of heavy vehicle chassis systems**

- a. the operation of electrical and electronic systems and components related to heavy vehicle chassis systems including:
  - i. ECU
  - ii. sensors and actuators
  - iii. electrical inputs
  - iv. voltages
  - v. oscilloscope patterns
  - vi. digital and fibre optic principles
- b. the interaction between the electrical/electronic system and mechanical components of chassis systems.
- c. electronic and electrical safety procedures.



### **Operation of electronic ABS, EBS, ASR and EBD braking systems**

- a. layout of:
  - i. ABS, EBS, ASR and EBD braking systems
  - ii. anti-lock braking
  - iii. anti-spin regulation systems
  - iv. warning systems
- b. operation of:
  - i. pneumatic, hydraulic and electronic control units
  - ii. wheel speed sensors
  - iii. load sensors
  - iii. hoses
  - iv. cables and connectors
- c. advantage of ABS and EBS braking systems over conventional braking systems.
- d. the relationship and interaction of electronic braking control with other vehicle systems

### **Steering geometry for advanced heavy vehicle applications**

- a. non-steered wheel geometry settings.
- b. front/rear wheel geometry:
  - i. castor
  - ii. camber
  - iii. kingpin or swivel pin inclination
  - iv. negative offset
  - v. wheel alignment (tracking)
  - vi. toe out on turns and steered wheel geometry
  - vii. Ackerman principle
  - viii. slip angles
  - ix. self-aligning torque
  - x. oversteer and understeer
  - xi. neutral steer
- c. the operation and layout of rear wheel steering and self-steered axles.
- d. the construction and operation of power assisted steering systems:
  - i. hydraulic system
  - ii. power cylinders
  - iii. drive belts and pumps
  - iv. hydraulic valve (rotary, spool and flapper type)

### **Components and operation of electronically controlled air suspension**

- a. the components, construction and operation of an electronically controlled air suspension system.
- b. the operation of electronically controlled air suspension systems under various conditions:
  - i. laden
  - ii. unladen
  - iii. cornering
- c. the relationship and interaction of electronically controlled air suspension with other vehicle systems

### **Symptoms and faults in braking systems**

- a. symptoms and faults associated with conventional braking systems, ABS, EBS and EBD systems:
  - i. mechanical
  - ii. hydraulic

- iii. electrical and electronic systems
- iv. fluid and air leaks
- v. poor brake efficiency
- vii. wheel locking under braking

### **Diagnosis and faults in braking systems**

- a. locate and interpret information for:
  - i. diagnostic tests
  - ii. vehicle and equipment specifications
  - iii. use of equipment
  - iv. testing procedures
  - v. test plans
  - vi. fault codes
  - vii. legal requirements
- b. prepare equipment for use in diagnostic testing.
- c. conduct systematic testing and inspection of:
  - i. braking system
  - ii. ABS
  - iii. pneumatic
  - iv. mechanical
  - v. hydraulic
  - vi. electrical and electronic systems
- d. using appropriate tools and equipment including:
  - i. multi-meters
  - ii. oscilloscope
  - iii. pressure gauges
- e. evaluate and interpret test results from diagnostic testing.
- f. compare test result and values with vehicle manufacturer's specifications and settings.
- g. how to dismantle components and systems using appropriate equipment and procedures.
- h. assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. probable faults, malfunctions, incorrect settings.
- j. rectification or replacement procedures.
- k. operation of systems following diagnosis and repair to confirm operation and performance.

### **Symptoms and faults associated with steering systems**

- a. symptoms and faults associated with steering systems:
  - i. mechanical
  - ii. hydraulic
  - iii. electrical and electronic
  - iv. steering boxes (rack and pinion, worm and re-circulating ball)
  - v. steering arms and linkages
  - vi. steering joints and bushes
  - vii. idler gears
  - viii. bearings
  - ix. steering columns (collapsible and absorbing)
  - x. power assisted steering system

### **Diagnosis and faults in steering systems**

- a. locate and interpret information for:
  - i. diagnostic tests
  - ii. vehicle and equipment specifications
  - iii. use of equipment

- iv. testing procedures
- v. test plans
- vi. fault codes
- vii. legal requirements
- b. how to prepare equipment for use in diagnostic testing.
- c. conduct systematic testing and inspection of:
  - i. steering systems
  - ii. mechanical
  - iii. hydraulic
  - iv. electrical and electronic systems
  - v. power assisted steering system
- d. using appropriate tools and equipment including:
  - i. multi-meters
  - ii. oscilloscope
  - iii. pressure gauges
  - iv. wheel alignment equipment
  - v. steering geometry equipment
- e. evaluate and interpret test results from diagnostic testing.
- f. compare test result and values with vehicle manufacturer's specifications and settings.
- g. how to dismantle, components and systems using appropriate equipment and procedures.
- h. assess, examine and evaluate the:
  - i. operation
  - ii. settings
  - iii. values
  - iv. condition and performance of components and systems
- i. probable faults, malfunctions, and incorrect settings.
- j. rectification or replacement procedures.
- k. operation of systems following diagnosis and repair to confirm operation and performance.

### **Symptoms and faults associated with suspension systems**

- a. symptoms and faults associated with suspension systems:
  - i. mechanical
  - ii. pneumatic
  - iii. electrical and electronic
  - iv. self-levelling and ride controlled suspension systems
  - v. ride height (unequal and low)
  - vi. wear
  - vii. noises under operation
  - viii. fluid or air leakage
  - ix. excessive travel
  - x. excessive tyre wear

## Diagnosis and faults in suspension systems

- a. locate and interpret information for:
  - i. diagnostic tests
  - ii. vehicle and equipment specifications
  - iii. use of equipment
  - iv. testing procedures
  - v. test plans
  - vi. fault codes
  - vii. legal requirements
- b. how to prepare equipment for use in diagnostic testing.
- c. how to conduct systematic testing and inspection of:
  - i. suspension systems
  - ii. mechanical
  - iii. hydraulic
  - iv. electrical and electronic systems
  - v. self-levelling and ride controlled suspension systems
- d. using appropriate tools and equipment including:
  - i. multi-meters
  - ii. oscilloscope
  - iii. pressure gauges
  - iv. alignment equipment
  - v. geometry equipment
- d. evaluate and interpret test results from diagnostic testing.
- e. compare test result and values with vehicle manufacturer's specifications and settings.
- f. how to dismantle, components and systems using appropriate equipment and procedures.
- g. assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- h. probable faults, malfunctions and incorrect settings.
- i. rectification or replacement procedures.
- j. operation of systems following diagnosis and repair to confirm operation and performance

## Unit 261

# Knowledge of overhauling heavy vehicle engine mechanical units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhauling heavy Vehicle engine Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of the construction and operation and overhaul of engines, gearboxes, final drive assemblies, steering and suspension units.

<b>Learning outcome</b>	The learner will:
	1. understand how to overhaul heavy vehicle engine units
<b>Assessment criteria</b>	
	The learner can:
	1.1 identify heavy vehicle engine unit components
	1.2 describe the construction and operation of heavy vehicle engine units
	1.3 explain how to prepare, use and assess all of the overhauling equipment
	1.4 explain how heavy vehicle engine units are dismantled, overhauled and reassembled
	1.5 explain common symptoms, causes and faults found in heavy vehicle engine units
	1.6 explain methods used to identify engine unit faults
	1.7 explain how to examine, measure and make suitable adjustments to heavy vehicle engine components
	1.8 explain how to evaluate and interpret test results found in diagnosing heavy vehicle engine unit faults and compare with manufacturer's specifications and settings
	1.9 explain how to evaluate the operation of components and systems following overhauling units to confirm system performance.

# **Unit 261                    Knowledge of overhauling heavy vehicle engine mechanical units**

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **How the units and assemblies being overhauled operate**

- a. identify unit components
- b. understand unit construction
- c. describe unit operation

### **How units are dismantled and reassembled**

- a. the dismantling procedure.
- b. tools and equipment used for stripping and rebuilding units and assemblies.
- c. methods of safe storage for removed components during overhaul activities.
- d. the process for assessing the condition of sub-assemblies including:
  - i. fit
  - ii. tolerances
  - iii. permitted limits
- e. the rebuild procedure for units and assemblies.
- f. adjustment procedures during re-assembly.

### **Unit and assembly testing and evaluation procedures**

- a. appropriate testing and evaluation procedures prior to dismantling units.
- b. appropriate testing and evaluation procedures of components after dismantling units.
- c. how to use overhauling and test equipment for the task.
- d. the cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. how to test and evaluate the performance of the overhauled units against the operating specification.
- f. how to interpret test results.
- g. adjustment procedures during final evaluation.

### **Faults associated with units and assemblies being overhauled**

- a. causes of faults and failures within units and assemblies.
- b. the faults associated with units and assemblies.
- c. how to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.

## Unit 263

# Knowledge of diagnosis and rectification of heavy transmission and driveline faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	<b>6</b>
<b>Relationship to NOS:</b>	This unit is linked to HV13 Diagnose and Rectify Commercial Motor Vehicle Transmission and Driveline System Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of diagnosis and rectification of heavy vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive units. It also covers the evaluation of performance of the systems.

<b>Learning outcome</b>	The learner will:
1. understand how the heavy vehicle transmission and driveline systems operate	
<b>Assessment criteria</b>	
The learner can:	
1.1 explain the construction and operation of heavy vehicle transmission and driveline systems	
1.2 explain the interaction between electrical, electronic and mechanical components within heavy vehicle transmission and driveline systems	
1.3 explain how electrical systems interlink and interact, including multiplexing	
1.4 compare heavy vehicle transmission and driveline system components and assemblies against alternatives to identify differences in construction and operation	
1.5 identify the engineering principles that are related to heavy vehicle transmission and driveline systems	
a. friction	
b. torque transmission	
c. materials	
d. fluids and energy	
e. potential and kinetic energy.	

<b>Learning outcome</b>	The learner will:
2.	understand how to diagnose and rectify faults in heavy vehicle transmission and driveline systems
<b>Assessment criteria</b>	
The learner can:	
2.1	explain the symptoms and causes of faults found in heavy vehicle transmission and driveline systems
2.2	explain systematic diagnostic techniques used in identifying transmission and driveline system faults
2.3	explain how to examine, measure and make suitable adjustments components
2.4	explain how to carry out the rectification activities in order to correct the faults in the heavy vehicle transmission and driveline systems
2.5	explain how to select, prepare and use diagnostic and rectification equipment for heavy vehicle transmission and driveline systems
2.6	explain how to evaluate and interpret test results found in diagnosing heavy vehicle transmission and driveline system faults against vehicle manufacturer specifications and settings
2.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.



## **Unit 263 Knowledge of diagnosis and rectification of heavy transmission and driveline faults**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

#### **The construction and operation of transmission and driveline systems**

- a. Including:
  - i. friction clutches
  - ii. fluid couplings
  - iii. multi-speed gearboxes
  - iv. fully automatic - including electronic control
  - v. electronically controlled gearshift systems
  - vi. hub reduction
  - vii. final drive units
  - viii. hubs and shafts.
- b. Key principles relating to heavy vehicle transmission and driveline systems:
  - i. friction
  - ii. torque transmission
  - iii. materials
  - iv. fluids and energy
  - v. potential and kinetic energy.

#### **Electrical and electronic principles related to heavy vehicle transmission systems**

- a. the operation of electrical and electronic systems and components related to heavy vehicle transmission systems including:
  - i. ECU
  - ii. sensors and actuators
  - iii. electrical inputs and outputs
  - iv. voltages
  - v. oscilloscope patterns
  - vi. digital and fibre optic principles
- b. the interaction between the electrical/electronic system, hydraulic system and mechanical components of the transmission systems.
- c. electronic and electrical safety procedures.

#### **The operation heavy vehicle clutches and fluid couplings**

- a. the construction and operation of friction clutches (coil spring, diaphragm) including single and twin clutch designs.
- b. the construction and operation of fluid couplings including:
  - i. fluid flywheel

- ii. torque converter (torque multiplication, efficiency)
- iii. benefits of fluid couplings
- iv. benefits of torque converter over fluid flywheel

### **The operation of heavy vehicle transmissions and driveline systems**

- a. the construction and operation of manual gearboxes:
  - i. multi-speed gearboxes
  - ii. gear arrangements
  - iii. shaft and bearing arrangements
  - iv. synchromesh devices
  - v. interlock mechanisms
  - vi. linkages
  - vii. overdrive
  - viii. lubrication
- b. the construction and operation of automatic gearboxes including hydraulic and electronic control systems: operations of epicyclic gears (sun, planet, annulus and carrier), method for achieving different gear ratios using epicyclic gearing; hydraulic control systems, components and operation; electronic control system, components and operation.
- c. the construction and operation of the electronically controlled gearshift systems
- d. the construction and operation of final drive systems including:
  - i. conventional crown wheel and pinion
  - ii. differential gears
  - iii. differential lock
- e. the construction and operation of heavy vehicle tandem drive systems including third differential and differential locks.
- f. the operation of heavy vehicle traction control systems and launch control.
- g. the construction and operation of heavy vehicle hub arrangements.
- h. the construction and operation of:
  - i. drive shafts
  - ii. prop shafts including flexible joints and couplings
  - iii. universal joints
  - iv. constant velocity joints
  - v. sliding joints

### **Symptoms and faults in heavy vehicle transmissions and drive-line systems**

- a. clutch and coupling faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. fluid leaks
  - iv. slip
  - v. judder
  - vi. grab
  - vii. failure to release
- b. gearbox faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. loss of drive
  - iv. difficulty engaging or disengaging gears
  - v. automatic gear box types
  - vi. abnormal noises
  - vii. vibrations
  - viii. loss of drive
  - ix. failure to engage gear
  - x. failure to disengage gear

- xi. leaks
- xii. failure to operate
- xiii. incorrect shift patterns
- xiv. electrical and electronic faults
- c. final drive faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. loss of drive
  - iv. oil leaks
  - v. failure to operate
  - vi. electrical and electronic faults
- d. drive-lines and couplings:
  - i. abnormal noises
  - ii. vibrations
  - iii. loss of drive

### **Faults in heavy vehicle transmission systems**

- a. interpret information for diagnostic tests, vehicle and equipment specifications, use of equipment, testing procedures, test plans, fault codes and legal requirements.
- b. how to prepare equipment for use in diagnostic testing.
- c. how to conduct systematic testing and inspection of transmission system, mechanical, hydraulic, electrical and electronic systems using appropriate tools and equipment including, multimeter, oscilloscope and pressure gauges.
- d. how to carry out workshop based and road testing of vehicle and transmission system.
- e. evaluate and interpret test results from diagnostic and/or road testing.
- f. compare test result and values with vehicle manufacturer's specifications and settings.
- g. how to dismantle, components and systems using appropriate equipment and procedures.
- h. assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. probable faults, malfunctions and incorrect settings.
- j. rectification or replacement procedures.
- k. operation of systems following diagnosis and repair to confirm operation and performance.

### **Transmission units and components**

- a. friction clutches
- b. fluid couplings
- c. multi speed gearboxes
- d. fully automatic - including electronic control
- e. electronically controlled gearshift systems
- f. hub reduction
- g. final drive units
- h. hubs and shafts

### **Measurements and settings**

- a. settings
- b. input and output values
- c. voltages
- d. current consumption
- e. resistance
- f. output patterns with oscilloscope
- g. pressures
- h. condition
- i. wear and performance

## Unit 271

## Knowledge of overhauling heavy vehicle transmission units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	4
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of the construction and operation and overhaul of engines, gearboxes, final drive assemblies, steering and suspension units.

<b>Learning outcome</b>	The learner will:
1. understand how to overhaul heavy vehicle gearbox and final drive units	
<b>Assessment criteria</b>	
The learner can:	
1.1 identify heavy vehicle gearbox and final drive unit components	
1.2 describe the construction and operation of heavy vehicle gearbox and final drive units	
1.3 explain how to prepare, use and assess all of the overhauling equipment	
1.4 explain how heavy vehicle gearbox and final drive units are dismantled, overhauled and reassembled	
1.5 explain common symptoms, causes and faults found in heavy vehicle gearbox and final drive units	
1.6 explain methods used to identify gearbox and final drive unit faults	
1.7 explain how to examine, measure and make suitable adjustments to heavy vehicle gearbox and final drive components	
1.8 explain how to evaluate and interpret test results found in diagnosing heavy vehicle gearbox and final drive unit faults and compare with manufacturer's specifications and settings	
1.9 explain how to evaluate the operation of components and system following overhauling units to confirm system performance.	

## **Unit 271                      Knowledge of overhauling heavy vehicle transmission units**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

#### **How the units and assemblies being overhauled operate**

- a. identify unit components
- b. understand unit construction
- c. describe unit operation

#### **How units are dismantled and reassembled**

- a. the dismantling procedure.
- b. tools and equipment used for stripping and rebuilding units and assemblies.
- c. methods of safe storage for removed components during overhaul activities.
- d. the process for assessing the condition of sub-assemblies including:
  - i. fit
  - ii. tolerances
  - iii. permitted limits
- e. the rebuild procedure for units and assemblies.
- f. adjustment procedures during re-assembly.

#### **Unit and assembly testing and evaluation procedures**

- a. appropriate testing and evaluation procedures prior to dismantling units.
- b. appropriate testing and evaluation procedures of components after dismantling units.
- c. how to use overhauling and test equipment for the task.
- d. the cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. how to test and evaluate the performance of the overhauled units against the operating specification.
- f. how to interpret test results.
- g. adjustment procedures during final evaluation.

#### **Faults associated with units and assemblies being overhauled**

- a. causes of faults and failures within units and assemblies.
- b. the faults associated with units and assemblies.
- c. how to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.

## **The procedures for dismantling, removal and replacement of electrical and electronic units and components**

- a. the preparation, testing and use of:
  - i. tools and equipment
  - ii. removal and replacement of electrical and electronic systems and components
- b. appropriate safety precautions:
  - i. PPE
  - ii. vehicle protection when dismantling
  - iii. removal and replacing electrical and electronic components and systems
- c. the importance of logical and systematic processes.
- d. preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
- e. the reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- f. refitting procedures.
- g. the inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- h. inspection and re-instatement of the vehicle following repair to ensure:
  - i. customer satisfaction
  - ii. cleanliness of vehicle interior and exterior
  - iii. security of components and fittings
  - iv. re-instatement of components and fittings
  - v. cancelling of any fault codes and warning lights.

## Unit 281

# Knowledge of overhauling heavy vehicle steering and suspension units

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	4
<b>Relationship to NOS:</b>	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of the construction and operation and overhaul of engines, gearboxes, final drive assemblies, steering and suspension units.

<b>Learning outcome</b>	The learner will:
1. understand how to overhaul heavy vehicle steering and suspension units	
<b>Assessment criteria</b>	
The learner can:	
1.1	identify heavy vehicle steering and suspension unit components
1.2	describe the construction and operation of heavy vehicle steering and suspension units
1.3	explain how to prepare, use and assess all of the overhauling equipment
1.4	explain how heavy vehicle steering and suspension units are dismantled, overhauled and reassembled
1.5	explain common symptoms, causes and faults found in heavy vehicle steering and suspension units
1.6	explain methods used to identify steering and suspension unit faults
1.7	explain how to examine, measure and make suitable adjustments to heavy vehicle steering and suspension components
1.8	explain how to evaluate and interpret test results found in diagnosing heavy vehicle steering and suspension unit faults and compare with manufacturer's specifications and settings
1.9	explain how to evaluate the operation of components and systems following overhauling units to confirm system performance.

## **Unit 281                    Knowledge of overhauling heavy vehicle steering and suspension units**

### Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

#### **How the units and assemblies being overhauled operate**

- a. identify unit components
- b. understand unit construction
- c. describe unit operation

#### **How units are dismantled and reassembled**

- a. The dismantling procedure.
- b. Tools and equipment used for stripping and rebuilding units and assemblies.
- c. Methods of safe storage for removed components during overhaul activities.
- d. The process for assessing the condition of sub-assemblies including:
  - i. fit
  - ii. tolerances
  - iii. permitted limits
- e. The rebuild procedure for units and assemblies.
- f. Adjustment procedures during re-assembly.

#### **Unit and assembly testing and evaluation procedures**

- a. Appropriate testing and evaluation procedures prior to dismantling units.
- b. Appropriate testing and evaluation procedures of components after dismantling units.
- c. How to use overhauling and test equipment for the task.
- d. The cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. How to test and evaluate the performance of the overhauled units against the operating specification.
- f. How to interpret test results.
- g. Adjustment procedures during final evaluation.

#### **Faults associated with units and assemblies being overhauled**

- a. Causes of faults and failures within units and assemblies.
- b. The faults associated with units and assemblies.
- c. How to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.



## **The procedures for dismantling, removal and replacement of electrical and electronic units and components**

- a. The preparation, testing and use of:
  - i. tools and equipment
  - ii. electrical meters and equipment used for dismantling
  - iii. removal and replacement of electrical and electronic systems and components
- b. Appropriate safety precautions:
  - i. PPE
  - ii. vehicle protection when dismantling
  - iii. removal and replacing electrical and electronic components and systems
- c. The importance of logical and systematic processes.
- d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
- e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- f. Refitting procedures.
- g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- h. Inspection and re-instatement of the vehicle following repair to ensure:
  - i. customer satisfaction
  - ii. cleanliness of vehicle interior and exterior
  - iii. security of components and fittings
  - iv. re-instatement of components and fittings
  - v. cancelling of any fault codes and warning lights

## Unit 406

## Skills in diagnosing and rectifying vehicle auxiliary electrical faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	5
<b>Relationship to NOS:</b>	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit will help the learner to develop the skills required to demonstrate they can diagnose and rectify automotive vehicle auxiliary electrical system faults. It also covers the evaluation of performance of the replaced or repaired units and systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

<b>Learning outcome</b>	<b>The learner will:</b>
1.	be able to work safely when carrying out automotive vehicle auxiliary electrical diagnostic and rectification activities
<b>Assessment criteria</b>	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout when carrying out auxiliary electrical diagnostic and rectification activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	be able to use relevant information to carry out the task
<b>Assessment criteria</b>	
The learner can:	
2.1	select suitable sources of technical information to support automotive vehicle diagnostic and rectification activities including: <ol style="list-style-type: none"> <li>a. vehicle technical data</li> <li>b. diagnostic test procedures</li> </ol>
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of automotive auxiliary electrical system faults.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	be able to use appropriate tools and equipment
<b>Assessment criteria</b>	
The learner can:	
3.1	select the appropriate tools and equipment necessary for diagnostic and rectification activities
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the equipment required, correctly and safely throughout all automotive auxiliary electrical diagnostic and rectification activities.

<b>Learning outcome</b>	<b>The learner will:</b>
4.	be able to carry out automotive vehicle auxiliary electrical diagnosis, rectification and test activities
<b>Assessment criteria</b>	
The learner can:	
4.1	use diagnostic methods that are relevant to the symptoms presented
4.2	evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately
4.3	carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> <li>a. manufacturers' instructions</li> <li>b. recognised researched repair methods</li> <li>c. health and safety requirements</li> </ul>
4.4	ensure all repaired or replacement components and units conform to the vehicle operating specification and any legal requirements
4.5	adjust components and units correctly to ensure that they operate to meet system requirements
4.6	use testing methods that are suitable for assessing the performance of the system rectified
4.7	ensure the rectified automotive auxiliary electrical system performs to the vehicle operating specification and any legal requirements.

<b>Learning outcome</b>	<b>The learner will:</b>
5.	be able to record information and make suitable recommendations
<b>Assessment criteria</b>	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

## Unit 456

## Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults

<b>Level:</b>	<b>7</b>
<b>Credit value:</b>	6
<b>Relationship to NOS:</b>	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
<b>Aim:</b>	This unit enables the learner to develop an understanding of diagnosis and rectification of vehicle auxiliary electrical systems and their units. It also covers the evaluation of performance of the systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

<b>Learning outcome</b>	<b>The learner will:</b>
1. understand vehicle electrical and electronic principles	
<b>Assessment criteria</b>	
The learner can:	
1.1	explain the principles of electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics
1.2	explain the principles of sensor inputs, computer processing and actuator outputs
1.3	identify sensor types (passive and active)
1.4	identify the electrical principles that are related to light vehicle electrical circuits.

<b>Learning outcome</b>	<b>The learner will:</b>
2.	understand how light vehicle auxiliary electrical systems operate
<b>Assessment criteria</b>	
The learner can:	
2.1	identify advanced automotive auxiliary electrical system components
2.2	explain the construction and operation of automotive auxiliary electrical systems
2.3	explain the interaction between electrical, electronic and mechanical components within the system defined
2.4	explain the operation of the electrical and electronic systems for electric, hybrid and alternative fuel vehicles including regenerative braking systems
2.5	explain how electrical systems interlink and interact, including multiplexing and fibre optics
2.6	compare automotive auxiliary electrical system components and assemblies against alternatives to identify differences in construction and operation.

<b>Learning outcome</b>	<b>The learner will:</b>
3.	understand how to diagnose and rectify faults in auxiliary electrical systems
<b>Assessment criteria</b>	
The learner can:	
3.1	explain the symptoms and causes of faults found in automotive auxiliary electrical systems
3.2	explain systematic diagnostic techniques used in identifying automotive auxiliary electrical system faults
3.3	explain how to examine, measure and make suitable adjustments to components
3.4	explain how to carry out the rectification activities in order to correct the faults in the automotive auxiliary electrical systems
3.5	explain how to select, prepare and use diagnostic and rectification equipment for automotive auxiliary electrical systems
3.6	explain how to evaluate and interpret test results found in diagnosing automotive auxiliary electrical system faults against vehicle manufacturer specifications and settings
3.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.

# **Unit 456                    Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults**

## Supporting information

**Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.**

### **The electrical principles that are related to light vehicle electrical circuits:**

- a. Ohms law
- b. Voltage
- c. Power
- d. Current (AC and DC)
- e. Resistance
- f. Magnetism
- g. Electromagnetism and electromagnetic induction
- h. Digital and fibre optic principles
- i. Electrical units and symbols
- j. Electrical and electronic terminology
- k. Relevant electrical safety.

### **Battery and charging**

- a. The construction and operation of vehicle batteries including:
  - i. low maintenance and maintenance free
  - ii. lead acid and nickel cadmium types
  - iii. cells
  - iv. separators
  - v. plates
  - vi. electrolyte.
- b. The operation of the vehicle charging system:
  - i. alternator
  - ii. rotor
  - iii. stator
  - iv. slip ring
  - v. brush assembly
  - vi. three phase output
  - vii. diode rectification pack
  - viii. voltage regulation
  - ix. phased winding connections
  - x. cooling fan
  - xi. alternator drive system.

### **Starting**

- a. The layout, construction and operation of engine starting systems:  
inertia and pre-engaged principles.

- b. The function and operation of the following components:
  - i. inertia and pre-engaged starter motor
  - ii. starter ring gear
  - iii. pinion
  - iv. starter solenoid
  - v. ignition/starter switch
  - vi. starter relay (if appropriate)
  - vii. one-way clutch (pre-engaged starter motor).

### **Lighting systems and technology**

- a. Lighting systems should include:
  - i. Xenon lighting
  - ii. gas discharge lighting
  - iii. ballast system
  - iv. LED
  - v. intelligent front lighting
  - vi. blue lights
  - vii. complex reflectors
  - viii. fibre optic
  - ix. optical patterning.

### **Lighting circuits and the relationship between each circuit**

- a. Circuits must include:
  - i. sidelights including number plate lights and marker lights
  - ii. dipped beam
  - iii. main beam
  - iv. dim/dip
  - v. indicators and hazard lights
  - vi. high intensity and fog light.

### **Common faults and testing methods associated with external lighting system**

- a. Fault diagnosis for:
  - i. lighting systems failing to operate correctly
  - ii. switches
  - iii. relays
  - iv. bulbs failing to operate.

### **The operating principles of external lighting systems and multiplexing systems**

- a. To include all external lighting systems and a good knowledge of multiplexing systems.

### **The different types of electric windows and mirror systems and components**

- a. Components should include:
  - i. window
  - ii. mirror motors
  - iii. multi-functional switches
  - iv. relays
  - v. total closure modules.

### **The function of component parts in the electric window and mirror systems**

- a. Components must include:
  - i. motors
  - ii. relays
  - iii. interfaces
  - iv. modules
  - v. switches.

### **The operating principles of electric windows and mirror systems**

- a. Operating principles of the following:
  - i. motors
  - ii. interfaces
  - iii. switches
  - iv. modules.

### **Common faults and testing methods associated with electric windows and mirror systems**

- a. Fault diagnosis for:
  - i. electric windows failing to open or close
  - ii. electric mirrors fail to adjust
  - iii. slow operation on both systems.

### **The different types of screen heating systems and components**

- a. Systems must include:
  - i. heated front screens
  - ii. heated rear screens
  - iii. heated mirrors.

### **The function and operating principles of components for heated screen and mirror systems**

- a. Components must include:
  - i. front and rear screen elements
  - ii. mirror elements
  - iii. time control relays
  - iv. multifunction relays and switches.

### **Common faults and testing methods associated with heated screen and mirror systems**

- a. Faults must include:
  - i. screen elements not operating
  - ii. timer relays not operating and staying on permanently.

### **The different types of I.C.E. systems and components**

- a. Systems and components must include:
  - i. radio CD and multi play units
  - ii. DVD players
  - iii. MP3 players
  - iv. speakers
  - v. aerial systems
  - vi. amplifiers
  - vii. V.D.U. screens
  - viii. Satellite Navigation
  - ix. communication units.



### **The function of components in I.C.E. systems**

- a. Systems include:
  - i. radios
  - ii. CD players
  - iii. video players
  - iv. DVD players
  - v. aerial systems
  - vi. speakers
  - vii. amplifiers
  - viii. VDU screens
  - ix. mobile communication units.

### **The operating principles of I.C.E. systems**

- a. Operation of entertainment systems speaker and aerial systems.

### **Common faults and testing methods associated with I.C.E. systems**

- a. Faults to include:
  - i. entertainment and navigation units not operating
  - ii. speaker, aerial and amplifier systems not functioning correctly
  - iii. excessive radio interference (suppression)
  - iv. use of diagnostic computers and systems.

### **The different types of integrated security/warning systems and components**

- a. Components to include:
  - i. control units
  - ii. alarm modules
  - iii. audible warning units
  - iv. immobiliser units
  - v. sensing units
  - vi. horn
  - vii. audible warning speakers.

### **The function of component parts in integrated security and warning systems**

- a. Components to include
  - i. control units
  - ii. alarm modules
  - iii. audible warning units
  - iv. interior sensing systems
  - v. immobiliser units
  - vi. relays
  - vii. LEDs
  - viii. horns.

### **The operating principles of integrated security and warning systems**

- a. Operation of alarm systems and audible warning units.

### **The relevant legislation relevant to security and warning systems**

- a. Find and apply all relevant legislation for the fitment and use of security and warning systems.

## **Common faults and testing methods associated with security and warning systems**

- a. Components to include:
  - i. control units
  - ii. audible warning units
  - iii. immobiliser units
  - iv. horns
  - v. relays
  - vi. LEDs
  - vii. wiring
  - viii. connections and protection devices
  - ix. removal and refitting procedures
  - x. using computer diagnostics to identify faults
  - xi. use of manufacturer's diagnostic equipment.

## **The different wiper system components**

- a. Components must include:
  - i. wiper motors
  - ii. washer motors
  - iii. wiper linkage
  - iv. multifunction relays
  - v. headlamp wash/wipe.

## **The function of component wiper and washer components**

- a. Components and systems must include:
  - i. wiper motors
  - ii. intermittent wash wipe relays
  - iii. parking systems.

## **The operating principles, faults and testing methods of wiper and washer systems**

- a. Principles, fault diagnosis and testing for:
  - i. wiper motors failing
  - ii. damaged linkages
  - iii. incorrect operation of intermittent and parking systems
  - iv. earth faults
  - v. control unit failure.

## **The different heater, cooling system components and air con.**

- a. Components include:
  - i. heater motors
  - ii. speed rheostats
  - iii. switches
  - iv. valves
  - v. radiator cooling fan motors
  - vi. relays
  - vii. air conditioning units.

### **The function of component heater, cooling parts and air conditioning**

- a. Components include:
  - i. heater motors
  - ii. rheostats
  - iii. valves
  - iv. switches
  - v. relays
  - vi. cooling fan motors
  - vii. air conditioning units
  - viii. thermostatic switches.

### **The operating principles of heater, cooling systems and air conditioning**

- a. Principles to include:
  - i. conduction
  - ii. convection
  - iii. radiation
  - iv. circulation
  - v. boiling points
  - vi. states of matter (Gas, liquid, solid)
  - vii. temperature control
  - viii. antifreeze mixtures
  - ix. heat transfer.

### **Common faults and testing methods associated with heater, cooling systems and air conditioning**

- a. Fault diagnosis for:
  - i. heater motor failing to operate on all/one speed
  - ii. radiator cooling fan not operating
  - iii. valves
  - iv. relays
  - v. switches not operating
  - vi. electrical related faults on the air conditioning system.

### **The different types of locking system components**

- a. Door locking actuators, solenoids, deadlocking actuators, anti-theft modules and boot release solenoids.

### **The function of component parts in the locking system**

- a. Solenoids, actuators (electrical and pneumatic), multifunctional relays, anti-theft modules and release systems.

### **The operating principles of locking systems**

- a. Doors and cabs.

### **Common faults and testing methods associated with locking systems**

- a. Door locking actuators, solenoids, connections, wiring, relays, and protection devices/fuses.

### **The different types of Supplementary Restraint and Airbag systems**

- a. Components include:
  - i. control units
  - ii. sensors

- iii. seat belt pretensioners
- iv. airbag assemblies
- v. wiring systems
- vi. warning systems.

### **The function of component parts in the Supplementary Restraint and Airbag systems**

- a. Components include:
  - i. control units
  - ii. interfaces
  - iii. sensors
  - iv. airbag units
  - v. pretensioners.

### **The operating principles of Supplementary Restraint and Airbag systems**

- a. Operation of the sensors.
- b. Operation of the airbag unit.
- c. Operation of the various types of pretension.
- d. Safe handling procedures and regulations.

### **Common faults and testing methods associated Supplementary Restraint and Airbag systems**

- a. Fault diagnosis for Airbag and SRS faults:
  - i. fault code identification
  - ii. wiring faults
  - iii. component failure
  - iv. earth problems
  - v. sensor faults.

### **How to examine, measure and make suitable adjustments to components:**

- a. Settings
- b. Input and output values
- c. Voltages
- d. Current consumption
- e. Resistance
- f. Input and output patterns with oscilloscope (including frequency and duty cycle
- g. measurements)
- h. Condition
- i. Wear and performance

### **How to select, prepare and use diagnostic and rectification equipment for automotive auxiliary electrical systems:**

- a. Voltmeters
- b. Ammeters
- c. Ohmmeters
- d. Multi-meters
- e. Battery testing equipment
- f. Dedicated and computer based diagnostic equipment
- g. Oscilloscopes.



## Appendix 1 Relationships to other qualifications

### Links to other qualifications

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

This qualification has connections to the 4310 SVQ 2/3 in Heavy Vehicle Maintenance and Repair at SCQF Level 5/7.



## Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on [www.cityandguilds.com](http://www.cityandguilds.com).

**Centre Manual - Supporting Customer Excellence** contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

**Our Quality Assurance Requirements** encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

**Access to Assessment & Qualifications** provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

## Useful contacts

<b>UK learners</b> <b>General qualification information</b>	<b>T: +44 (0)844 543 0033</b> <b>E: learnersupport@cityandguilds.com</b>
<b>International learners</b> General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: <b>intcg@cityandguilds.com</b>
<b>Centres</b> Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: <b>centresupport@cityandguilds.com</b>
<b>Single subject qualifications</b> Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: <b>singlesubjects@cityandguilds.com</b>
<b>International awards</b> Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: <b>intops@cityandguilds.com</b>
<b>Walled Garden</b> Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: <b>walledgarden@cityandguilds.com</b>
<b>Employer</b> Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: <b>business@cityandguilds.com</b>
<b>Publications</b> Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

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If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: [feedbackandcomplaints@cityandguilds.com](mailto:feedbackandcomplaints@cityandguilds.com)



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## City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

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HB-04-4390