

# Specification

**Edexcel BTEC Level 2 and 3 Diploma in Heavy Vehicle  
Maintenance and Repair Principles (QCF)**

**Edexcel Level 2 and 3 Diploma in Heavy Vehicle  
Maintenance and Repair Competence (QCF)**

First registration September 2010



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## Qualification titles covered by this specification

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This specification gives you the information you need to offer the Edexcel Principles and Competence qualifications in Heavy Vehicle Maintenance and Repair at Level 2 and Level 3.

<b>Qualification title</b>	<b>Qualification Number (QN)</b>	<b>Operational start date</b>
Edexcel BTEC Level 2 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF)	501/0192/4	01/09/2010
Edexcel Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF)	501/0197/3	01/09/2010
Edexcel BTEC Level 3 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF)	501/0194/8	01/09/2010
Edexcel Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF)	501/0249/7	01/09/2010

These qualifications have been accredited within the Qualifications and Credit Framework (QCF) and are eligible for public funding as determined by the Department for Education (DfE) under Section 96 of the Learning and Skills Act 2000.

The qualification titles listed above feature in the funding lists published annually by the DfE and the regularly updated website. They will also appear on the Learning Aim Reference Application (LARA), where relevant.

You should use the QCF Qualification Number (QN), when you wish to seek public funding for your learners. Each unit within a qualification will also have a unique QCF unit reference number, which is listed in this specification.

The QCF qualification title and unit reference numbers will appear on the learners' final certification document. Learners need to be made aware of this when they are recruited by the centre and registered with Edexcel.

## **Key features of the Edexcel Principles and Competence qualifications in Heavy Vehicle Maintenance and Repair (QCF) at Level 2 and Level 3**

These qualifications:

- are nationally recognised
- are based on the Maintenance & Repair – Heavy Vehicle National Occupational Standards (NOS). The NOS, assessment strategy and qualification structure(s) are owned by the Sector Skills Council, The Institute of the Motor Industry (IMI).

The Edexcel BTEC Level 2 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF) and the Edexcel Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF) have been approved as components in the Intermediate apprenticeship framework in Vehicle Maintenance and Repair.

The Edexcel BTEC Level 3 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF) and the Edexcel Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence have been approved as components in the Advanced apprenticeship framework in Vehicle Maintenance and Repair.

### **What is the purpose and benefits of these qualifications?**

These qualifications provide learners with flexible access to industry supported Level 2 and 3 skills programmes, which act as a real alternative to academic qualifications for those who prefer this style of learning and achievement. As part of apprenticeship frameworks, the qualification support learners in providing a career pathway into jobs and training at technician level and higher.

Learners will have the opportunity to learn and demonstrate their skills, knowledge and competence in routine heavy vehicle maintenance and inspections including servicing, repairing and replacing faulty parts and maintaining records.

### **Who are these qualifications for?**

These qualifications are for all learners aged 16 and above who are capable of reaching the required standards.

Edexcel's policy is that the qualifications should:

- be free from any barriers that restrict access and progression
- ensure equality of opportunity for all wishing to access the qualification(s).

Centres should be aware that within the Level 2 qualifications in this specification, learners will be required to meet the demands of unit(s) at Level 3. Centres are advised to consider the support, guidance and opportunities they give to learners to meet the demands of the higher level units during delivery and assessment of the qualification.

**What are the potential job roles for those working towards these qualifications?**

- Heavy Vehicle Service Technician (Level 2)
- Heavy Vehicle Diagnostic Technician (Level 3)

**What progression opportunities are available to learners who achieve these qualifications?**

Learners can progress on to other Edexcel automotive apprenticeship programmes and/or related qualifications detailed in *Annexe A*. Other progression routes include; further work or work experience, academic qualification(s) such as one or more GCSEs, Higher Education and or Foundation Degree, or employment into a range of jobs at Level 2 and 3.

# What is the qualification structure for the Edexcel BTEC Level 2 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF)?

A total of 78 credits are required to achieve this qualification. Learners must achieve a minimum of: 29 credits from the 6 mandatory generic units (Group A), 44 credits from the 10 mandatory specialist units (Group B) and a minimum of 5 credits from 1 of the optional groups (Groups D or E) ensuring all components of the selected optional unit group are achieved.

Individual units can be found in the *Units* section.

Unit Number	Unit Reference Number	Unit Title	Credit	Level
<b>Group A – Mandatory generic units</b>				
Learners must achieve 29 credits from this group.				
1	D/601/6171	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	3	2
2	Y/601/7254	Skills in Health, Safety and Good Housekeeping in the Automotive Environment	7	2
3	T/601/6175	Knowledge of Support for Job Roles in the Automotive Work Environment	3	3
4	J/601/6262	Skills in Supporting Job Roles in the Automotive Work Environment	5	3
5	K/601/6237	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	4	2
6	Y/601/6279	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	7	2
<b>Group B – Mandatory specialist units</b>				
Learners must achieve 44 credits from this group.				
9	J/601/4933	Knowledge of Conducting Routine Heavy Vehicle Maintenance	2	2
10	K/601/4973	Skills Required to Conduct Routine Heavy Vehicle Maintenance	3	2
11	D/601/4937	Knowledge of Heavy Vehicle Engine Mechanical, Lubrication and Cooling System Units and Components	3	2

<b>Unit Number</b>	<b>Unit Reference Number</b>	<b>Unit Title</b>	<b>Credit</b>	<b>Level</b>
12	T/601/4944	Knowledge of Heavy Vehicle Fuel, Air Supply and Exhaust System Units and Components	3	2
13	A/601/4976	Skills Required to Remove and Replace Heavy Vehicle Engine Units and Components	5	2
14	J/601/4947	Knowledge of Removing and Replacing Heavy Vehicle Electrical Units and Components	6	2
15	F/601/4977	Skills Required to Remove and Replace Heavy Vehicle Electrical Units and Components	5	2
16	L/601/4951	Knowledge of Heavy Vehicle Removing and Replacing Chassis Units and Components	6	2
17	L/601/4979	Skills Required to Remove and Replace Heavy Vehicle Chassis Units and Components	5	2
18	F/601/4963	Knowledge of Heavy Vehicle Transmission and Driveline Units and Components	6	2
<b>Optional Groups</b>				
<b>Learners must achieve a minimum of 5 credits from 1 of the optional groups. All sub-components of the chosen group must be completed.</b>				
<b>Group D – Optional unit group D</b>				
If this group is chosen, learners must achieve 6 credits.				
19	Y/601/4967	Knowledge of Inspecting Heavy Vehicles	4	2
20	F/601/4980	Skills Required to Inspect Heavy Vehicles Using Prescribed Methods	2	2
<b>Group E – Optional unit group E</b>				
If this group is chosen, learners must achieve 5 credits.				
21	J/601/4995	Skills Required to Remove and Replace Heavy Vehicle Transmission and Driveline Units and Components	5	2

# What is the qualification structure for the Edexcel Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF)?

A total of 101 credits are required to achieve this qualification. Learners must achieve a minimum of: 29 credits from the 6 mandatory generic units (Group A), 63 credits from the 10 mandatory specialist units (Group B) and a minimum of 9 credits from 1 of the optional unit groups (Groups D or E) ensuring all components of the selected optional unit group are achieved.

Individual units can be found in the Units section.

Unit Number	Unit Reference Number	Unit Title	Credit	Level
<b>Group A – Mandatory generic units</b>				
Learners must achieve 29 credits from this group.				
7	A/601/6338	Competency in Health, Safety and Good Housekeeping in the Automotive Environment	7	2
1	D/601/6171	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	3	2
8	K/601/6366	Competency in Supporting Job Roles in the Automotive Work Environment	5	3
3	T/601/6175	Knowledge of Support for Job Roles in the Automotive Work Environment	3	3
5	K/601/6237	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	4	2
6	Y/601/6279	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	7	2
<b>Group B – Mandatory specialist units</b>				
Learners must achieve 63 credits from this group.				
22	L/601/4903	Competency in Conducting Routine Heavy Vehicle Maintenance	7	2
9	J/601/4933	Knowledge of Conducting Routine Heavy Vehicle Maintenance	2	2
11	D/601/4937	Knowledge of Heavy Vehicle Engine Mechanical, Lubrication and Cooling System Units and Components	3	2

Unit Number	Unit Reference Number	Unit Title	Credit	Level
12	T/601/4944	Knowledge of Heavy Vehicle Fuel, Air Supply and Exhaust System Units and Components	3	2
23	R/601/4904	Competency in Removing And Replacing Heavy Vehicle Engine Units and Components	10	2
24	Y/601/4905	Competency in Removing And Replacing Heavy Vehicle Electrical Units and Components	10	2
14	J/601/4947	Knowledge of Removing and Replacing Heavy Vehicle Electrical Units and Components	6	2
25	M/601/7356	Competency in Removing and Replacing Heavy Vehicle Chassis Units and Components	10	2
16	L/601/4951	Knowledge of Heavy Vehicle Removing and Replacing Chassis Units and Components	6	2
18	F/601/4963	Knowledge of Heavy Vehicle Transmission and Driveline Units and Components	6	2
<b>Optional Groups</b>				
<b>Learners must achieve a minimum of 9 credits from 1 of the optional groups. All sub-components of the chosen group must be completed.</b>				
<b>Group D – Optional unit group D</b>				
If this group is chosen, learners must achieve 9 credits.				
19	Y/601/4967	Knowledge of Inspecting Heavy Vehicles	4	2
26	D/601/4906	Competency Required to Inspect Heavy Vehicles Using Prescribed Methods	5	2
<b>Group E – Optional unit group E</b>				
If this group is chosen, learners must achieve 10 credits.				
27	M/601/4926	Competency in Removing and Replacing Heavy Vehicle Transmission and Driveline Units and Components	10	2

# What is the qualification structure for the Edexcel BTEC Level 3 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF)?

A total of 79 credits are required to achieve this qualification. Learners must achieve a minimum of: 29 credits from the 6 mandatory generic units (Group A), 45 credits from the 9 mandatory specialist units (Group B) and a minimum of 5 credits from 1 of the optional unit groups (Groups D, E, F, G, H or I) ensuring all components of the selected optional unit group are achieved.

Individual units can be found in the Units section.

Unit Number	Unit Reference Number	Unit Title	Credit	Level
<b>Group A – Mandatory generic units</b>				
Learners must achieve 29 credits from this group.				
1	D/601/6171	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	3	2
2	Y/601/7254	Skills in Health, Safety and Good Housekeeping in the Automotive Environment	7	2
3	T/601/6175	Knowledge of Support for Job Roles in the Automotive Work Environment	3	3
4	J/601/6262	Skills in Supporting Job Roles in the Automotive Work Environment	5	3
5	K/601/6237	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	4	2
6	Y/601/6279	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	7	2
<b>Group B – Mandatory specialist units</b>				
Learners must achieve 45 credits from this group.				
28	A/601/3746	Knowledge of Diagnosis and Rectification of Vehicle Auxiliary Electrical Faults	6	3
29	H/601/3868	Skills in Diagnosing and Rectifying Vehicle Auxiliary Electrical Faults	5	3
19	Y/601/4967	Knowledge of Inspecting Heavy Vehicles	4	2
30	R/601/4983	Skills Required to Inspect Heavy Vehicles to Comply With Legal Requirements	2	3

Unit Number	Unit Reference Number	Unit Title	Credit	Level
31	Y/601/4953	Knowledge of Diagnosis and Rectification of Heavy Vehicle Engine Faults	6	3
32	Y/601/4984	Skills in Diagnosing and Rectifying Heavy Vehicle Engine Faults	5	3
33	K/601/4956	Knowledge of Diagnosis and Rectification of Heavy Vehicle Chassis Faults	6	3
34	D/601/4985	Skills in Diagnosing and Rectifying Heavy Vehicle Chassis System Faults	5	3
51	L/601/4965	Knowledge of Diagnosis and Rectification of Heavy Transmission and Driveline Faults	6	3
<b>Optional Groups</b> <b>Learners must achieve a minimum of 5 credits from 1 of the optional groups. All sub-components of the chosen group must be completed.</b>				
<b>Group D – Optional unit group D</b> If this group is chosen, learners must achieve 10 credits.				
38	T/601/6242	Knowledge of how to Make Learning Possible through Demonstrations and Instruction	5	3
39	Y/601/6282	Skills in how to Make Learning Possible through Demonstrations and Instruction	5	3
<b>Group E – Optional unit group E</b> If this group is chosen, learners must achieve 10 credits.				
41	R/601/6247	Knowledge of how to Identify and Agree Motor Vehicle Customer Service Needs	5	3
42	M/601/6286	Skills to Identify and Agree Motor Vehicle Customer Service Needs	5	3
<b>Group F – Optional unit group F</b> If this group is chosen, learners must achieve 11 credits.				
43	M/601/4957	Knowledge of Overhauling Heavy Vehicle Engine Mechanical Units	5	3
44	T/601/4989	Skills Required to Overhaul Heavy Vehicle Engine Mechanical Units	6	3

<b>Group G – Optional unit group G</b>				
If this group is chosen, learners must achieve 10 credits.				
45	A/601/4959	Knowledge of Overhauling Heavy Vehicle Transmission Units	4	3
48	K/601/4990	Skills Required to Overhaul Heavy Vehicle Transmission Units	6	3
<b>Group H – Optional unit group H</b>				
If this group is chosen, learners must achieve 10 credits.				
49	T/601/4961	Knowledge of Overhauling Heavy Vehicle Steering and Suspension Units	4	3
50	A/601/4993	Skills Required to Overhaul Heavy Vehicle Steering and Suspension Units	6	3
<b>Group I – Optional unit group I</b>				
If this group is chosen, learners must achieve 5 credits.				
52	R/601/4997	Skills in Diagnosing and Rectifying Heavy Vehicle Transmission and Driveline Faults	5	3

# What is the qualification structure for the Edexcel Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF)?

A total of 102 credits are required to achieve this qualification. Learners must achieve a minimum of: 29 credits from the 6 mandatory generic units (Group A), 63 credits from the 9 mandatory specialist units (Group B) and a minimum of 10 credits from 1 of the optional unit groups (Groups D, E, F, G, H or I) ensuring all components of the selected optional unit group are achieved.

Individual units can be found in the Units section.

Unit Number	Unit Reference Number	Unit Title	Credit	Level
<b>Group A – Mandatory generic units</b>				
Learners must achieve 29 credits from this group.				
7	A/601/6338	Competency in Health, Safety and Good Housekeeping in the Automotive Environment	7	2
1	D/601/6171	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	3	2
8	K/601/6366	Competency in Supporting Job Roles in the Automotive Work Environment	5	3
3	T/601/6175	Knowledge of Support for Job Roles in the Automotive Work Environment	3	3
5	K/601/6237	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	4	2
6	Y/601/6279	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	7	2
<b>Group B – Mandatory specialist units</b>				
Learners must achieve 63 credits from this group.				
56	L/601/3749	Competency in Diagnosing and Rectifying Vehicle Auxiliary Electrical Faults	10	3
28	A/601/3746	Knowledge of Diagnosis and Rectification of Vehicle Auxiliary Electrical Faults	6	3
9	Y/601/4967	Knowledge of Inspecting Heavy Vehicles	4	2

Unit Number	Unit Reference Number	Unit Title	Credit	Level
35	H/601/4910	Competency Required to Inspect Heavy Vehicles to Comply with Legal Requirements	5	3
36	M/601/4912	Competency in Diagnosing and Rectifying Heavy Vehicle Engine Faults	10	3
31	Y/601/4953	Knowledge of Diagnosis and Rectification of Heavy Vehicle Engine Faults	6	3
37	A/601/4914	Competency in Diagnosing and Rectifying Heavy Vehicle Chassis System Faults	10	3
33	K/601/4956	Knowledge of Diagnosis and Rectification of Heavy Vehicle Chassis Faults	6	3
51	L/601/4965	Knowledge of Diagnosis and Rectification of Heavy Transmission and Driveline Faults	6	3
<b>Optional Groups</b>				
<b>Learners must achieve a minimum of 10 credits from 1 of the optional groups. All sub-components of the chosen group must be completed.</b>				
<b>Group D – Optional unit group D</b>				
If this group is chosen, learners must achieve 10 credits.				
40	Y/601/6380	Competency in Making Learning Possible through Demonstrations and Instruction	5	3
38	T/601/6242	Knowledge of how to Make Learning Possible through Demonstrations and Instruction	5	3
<b>Group E – Optional unit group E</b>				
If this group is chosen, learners must achieve 10 credits.				
46	K/601/6383	Competency in Identifying and Agreeing Motor Vehicle Customer Service Needs	5	3
41	R/601/6247	Knowledge of how to Identify and Agree Motor Vehicle Customer Service Needs	5	3
<b>Group F – Optional unit group F</b>				
If this group is chosen, learners must achieve 11 credits.				
47	L/601/4917	Competency in Overhauling Heavy Vehicle Engine Mechanical Units	6	3
43	M/601/4957	Knowledge of Overhauling Heavy Vehicle Engine Mechanical Units	5	3

Unit Number	Unit Reference Number	Unit Title	Credit	Level
<b>Group G – Optional unit group G</b>				
If this group is chosen, learners must achieve 10 credits.				
53	R/601/4921	Competency in Overhauling Heavy Vehicle Transmission Units	6	3
45	A/601/4959	Knowledge of Overhauling Heavy Vehicle Transmission Units	4	3
<b>Group H – Optional unit group H</b>				
If this group is chosen, learners must achieve 10 credits.				
54	H/601/4924	Competency in Overhauling Heavy Vehicle Steering and Suspension Units	6	3
49	T/601/4961	Knowledge of Overhauling Heavy Vehicle Steering and Suspension Units	4	3
<b>Group I – Optional unit group I</b>				
If this group is chosen, learners must achieve 10 credits.				
55	F/601/4929	Competency in Diagnosing and Rectifying Heavy Vehicle Transmission and Driveline Faults	10	3



## How are the qualifications graded and assessed?

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The overall grade for the qualifications is a 'pass'. The learner must achieve all the required units within the specified qualification structure.

To pass a unit the learner must:

- achieve **all** the specified learning outcomes
- satisfy **all** the assessment criteria by providing sufficient and valid evidence for each criterion
- show that the evidence is their own.

The qualifications are designed to be assessed:

- in the workplace or
- in conditions resembling the workplace, as specified in the assessment requirements/strategy for the sector, or
- as part of a training programme.

### Assessment strategy for Competence based qualifications (VCQs)

The assessment strategy for the competence qualifications (VCQ) has been included in *Annexe C*. It has been developed by IMI in partnership with employers, training providers, awarding organisations and the regulatory authorities. The assessment strategy includes details on:

- criteria for defining realistic working environments
- roles and occupational competence of assessors, expert witnesses, internal verifiers and standards verifiers
- quality control of assessment
- evidence requirements.

Evidence of competence may come from:

- **current practice** where evidence is generated from a current job role
- a **programme of development** where evidence comes from assessment opportunities built into a learning/training programme whether at or away from the workplace
- the **Recognition of Prior Learning (RPL)** where a learner can demonstrate that they can meet the assessment criteria within a unit through knowledge, understanding or skills they already possess without undertaking a course of learning. They must submit sufficient, reliable and valid evidence for internal and standards verification purposes. RPL is acceptable for accrediting a unit, several units or a whole qualification
- a **combination** of these.

It is important that the evidence is:

<b>Valid</b>	relevant to the standards for which competence is claimed
<b>Authentic</b>	produced by the learner
<b>Current</b>	sufficiently recent to create confidence that the same skill, understanding or knowledge persist at the time of the claim
<b>Reliable</b>	indicates that the learner can consistently perform at this level
<b>Sufficient</b>	fully meets the requirements of the standards.

## Types of evidence

To successfully achieve a unit the learner must gather evidence which shows that they have met the required standard in the assessment criteria. Evidence can take a variety of different forms including the examples below. Centres should refer to the assessment strategy for information about which of the following are permissible.

Centres should also refer to the assessment strategy (for competence based qualifications (VCQs) and the assessment requirements/evidence requirements section within each individual unit.

- direct observation of the learner's performance by their assessor (O)
- outcomes from oral or written questioning (Q&A)
- products of the learner's work (P)
- personal statements and/or reflective accounts (RA)
- outcomes from simulation, where permitted by the assessment strategy (S)
- professional discussion (PD)
- assignment, project/case studies (A)
- authentic statements/witness testimony (WT)
- expert witness testimony (EWT)
- evidence of Recognition of Prior Learning (RPL).

The abbreviations may be used for cross-referencing purposes.

Learners can use one piece of evidence to prove their knowledge, skills and understanding across different assessment criteria and/or across different units. It is, therefore, not necessary for learners to have each assessment criterion assessed separately. Learners should be encouraged to reference the assessment criteria to which the evidence relates.

Evidence must be made available to the assessor, internal verifier and Edexcel standards verifier. A range of recording documents is available on the Edexcel website [www.edexcel.com](http://www.edexcel.com). Alternatively, centres may develop their own.

# Centre recognition and approval

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## Centre recognition

Centres that have not previously offered Edexcel qualifications need to apply for and be granted centre recognition as part of the process for approval to offer individual qualifications. New centres must complete both a centre recognition approval application and a qualification approval application.

Existing centres will be given 'automatic approval' for a new qualification if they are already approved for a qualification that is being replaced by the new qualification and the conditions for automatic approval are met. Centres already holding Edexcel approval are able to gain qualification approval for a different level or different sector via Edexcel online.

## Approvals agreement

All centres are required to enter into an approvals agreement which is a formal commitment by the head or principal of a centre to meet all the requirements of the specification and any linked codes or regulations. Edexcel will act to protect the integrity of the awarding of qualifications, if centres do not comply with the agreement. This could result in the suspension of certification or withdrawal of approval.

## Quality assurance

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Quality assurance is at the heart of vocational qualifications. Assessment on BTEC and Competency qualifications is completed by your centre. You use quality assurance to ensure that your managers, internal verifiers and assessors are standardised and supported. We use quality assurance to check that all centres are working to national standards. It gives us the opportunity to identify and provide support where it is needed in order to safeguard certification. It also allows us to recognise and support good practice.

For the qualifications in this specification, the Edexcel quality assurance model will follow one of the three processes listed below.

- 1 Delivery of the **Competence and Principles** qualifications as part of a BTEC apprenticeship (single click registration)
  - integrated annual visits by a Standards Verifier to review centre-wide quality assurance systems and sampling of internal verification and assessor decisions

- 2 Delivery of the **Competence** qualification outside the apprenticeship
  - annual visits to centres by a Centre Quality Reviewer to review centre-wide quality assurance systems
  - annual visits by a Standards Verifier for sampling of internal verification and assessor decisions for the qualification
  
- 3 Delivery of the **Principles** qualification outside the apprenticeship
  - annual visits to centres by a Centre Quality Reviewer to review centre-wide quality assurance systems
  - Lead Internal Verifier accreditation. This involves online training and standardisation of Lead Internal Verifiers using our OSCA platform, accessed via Edexcel Online. Please note that not all qualifications are covered by Lead Internal Verifier accreditation. Where this is the case we will annually allocate a Standards Verifier to conduct postal sampling of internal verification and assessor decisions for the Principal Subject Area.

For further details, go to the UK BTEC Quality Assurance Handbook 2011-12  
<http://www.edexcel.com/quals/BTEC/quality/Pages/documents.aspx>

## What resources are required?

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Each qualification is designed to support learners working in the automotive sector. Physical resources need to support the delivery of the qualifications and the assessment of the learning outcomes and must be of industry standard.

For competence based qualifications (VCQs), centres must meet any specific resource and staff requirements outlined in *Annexe C: Assessment strategy*.

# Unit format

Each unit in this specification contains the following sections.

<b>Unit title:</b>					The unit title is approved on the QCF and this form of words will appear on the learner's Notification of Performance (NOP).	
<b>Unit reference number:</b>					This code is a unique reference number for the unit.	
<b>QCF level:</b>					All units and qualifications within the QCF have a level assigned to them, which represents the level of achievement. There are nine levels of achievement, from Entry level to level 8. The level of the unit has been informed by the QCF level descriptors and, where appropriate, the NOS and/or other sector/professional.	
<b>Credit value:</b>					All units have a credit value. The minimum credit value is one, and credits can only be awarded in whole numbers. Learners will be awarded credits when they achieve the unit.	
<b>Guided learning hours:</b>					A notional measure of the substance of a qualification. It includes an estimate of the time that might be allocated to direct teaching or instruction, together with other structured learning time, such as directed assignments, assessments on the job or supported individual study and practice. It excludes learner-initiated private study.	
<b>Unit summary:</b>					This provides a summary of the purpose of the unit.	
<b>Assessment requirements/evidence requirements:</b>					The assessment/evidence requirements are determined by the SSC. Learners must provide evidence for each of the requirements stated in this section.	
<b>Learning outcomes:</b>	<b>Assessment criteria:</b>	<b>Evidence type:</b>	<b>Portfolio reference:</b>	<b>Date:</b>		
			The learner should use this box to indicate where the evidence can be obtained eg portfolio page number.	The learner should give the date when the evidence has been provided.		
Learning outcomes state exactly what a learner should know, understand or be able to do as a result of completing a unit.		The assessment criteria of a unit specify the standard a learner is expected to meet to demonstrate that a learning outcome, or a set of learning outcomes, has been achieved.		Learners must reference the type of evidence they have and where it is available for quality assurance purposes. The learner can enter the relevant key and a reference. Alternatively, the learner and/or centre can devise their own referencing system.		



# Units



## **Unit 1: Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment**

**Unit reference number:** D/601/6171

**QCF level:** Level 2

**Credit value:** 3

**Guided learning hours:** 30

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### **Unit Summary**

This unit enables the learner to develop an understanding of:

- routine maintenance and cleaning of the automotive environment and using resources economically
- 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.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### **Economic use of Resources**

- a consumable materials e.g. 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 (current)
- i Safe Working Loads
- j Working at Height Regulations (current)

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

- a trainees 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

### **When and why safety equipment must be used**

- a location of safety equipment
- b particular hazards associated with their work area and equipment
- c prohibited areas
- d plant and machinery that trainees must not use or operate
- e why and how faults on unsafe equipment should be reported
- f storing tools, equipment and products safely and appropriately
- g using the correct PPE
- h following manufacturers' recommendations
- i 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**

- a electrical safety, pneumatics and hydraulics
- b accessing and interpreting safety information
- c seeking advice when needed
- d seeking assistance when required
- e reporting of unsafe equipment
- f storing tools, equipment and products safely and appropriately
- g using the correct PPE
- h following manufacturers recommendations
- i following application procedures e.g. hazardous substances
- j 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. 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, to include:
  - 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:
  - a round
  - b triangular
  - c 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 personal, customers, contractors etc entering your work premises
  - ix working by the roadside
  - x vehicle recovery

the employee's responsibilities in identifying and reporting risks within their working environment

- c the method of reporting risks that are outside your limits of authority
- d 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 policies 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand the correct personal and vehicle protective equipment to be used within the automotive environment	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			
2	Understand effective housekeeping practices in the automotive environment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand key health and safety requirements relevant to the automotive environment	2.7	describe procedures for starting and ending the working day which ensure effective housekeeping practices are followed			
		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			
		4.1	identify key hazards and risks in an automotive environment			
4	Understand about hazards and potential risks relevant to the 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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Understand personal responsibilities	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Unit 2: Skills in Health, Safety and Good Housekeeping in the Automotive Environment

Unit reference number: Y/601/7254

QCF level: Level 2

Credit value: 7

Guided learning hours: 60

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### Unit Summary

This unit will enable the learner to develop the skills required to:

- carry out day to day work area cleaning, clearing away, dealing with spillages and disposal of waste, used materials and debris
- identify hazards and risks in the automotive environment and complying with relevant legislation and good practice
- work safely at all times within the automotive environment, both as an individual and with others.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of use of personal and vehicle protection, cleaning the work environment and disposal of waste on **2** separate occasions
- 5 produce evidence of identifying risks which may result from at least 2 of the items listed below:
  - a the use and maintenance of machinery or equipment
  - b the use of materials or substances
  - c working practices which do not conform to laid down policies
  - d unsafe behaviour
  - e accidental breakages and spillages
  - f environmental factors

- 6 produce evidence of identifying risks
- 7 produce evidence of following at least 2 of the workplace policies listed below:
  - a the use of safe working methods and equipment
  - b the safe use of hazardous substances
  - c smoking, eating, drinking and drugs
  - d what to do in the event of an emergency
  - e personal presentation
- 8 produce evidence of following workplace policies.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to use correct personal and vehicle protection within the automotive environment	1.1	select and use personal protective equipment throughout activities. To include appropriate protection of: a eyes b ears c head d skin e feet f hands g lungs			
		1.2	select and use vehicle protective equipment throughout all activities			
2	Be able to carry out effective housekeeping practices in the automotive environment	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 manufacturer's 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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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			
3	Be able to recognise and deal with dangers in order to work safely within the automotive workplace	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			
4	Be able to conduct themselves responsibly	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)



## Unit 3: Knowledge of Support for Job Roles in the Automotive Work Environment

Unit reference number: T/601/6175

QCF level: Level 3

Credit value: 3

Guided learning hours: 20

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### Unit Summary

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.

#### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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
  
- b sources of information
  - i other staff
  - ii manuals
  - iii parts lists
  - iv computer software and the internet
  - v manufacturer
  - vi 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

### **Methods of communication**

- a verbal
- b signs and notices
- c memos
- d telephone
- e electronic mail
- f vehicle job card
- g notice boards
- h SMS text messaging
- i Letters

### **Organisational and customer requirements:**

- a importance of time scales to customer and organization
- b relationship between time and costs
- c meaning of profit

### **Choice of communication**

- a distance
- b location
- c job responsibility

### **Importance of maintaining positive working relationships:**

- a morale
- b productivity
- c company image
- d customer relationships
- e colleagues

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand key organisational structures, functions and roles within the automotive work environment	1.1	identify the purpose of 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 automotive workplace. To include: a trainee b skilled technician c supervisor d manager			
2	Understand the importance of obtaining, interpreting and using information in order to support their job role within the automotive work environment	2.1	explain the importance of different sources of information in a 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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand the importance of different types of communication within the automotive work environment	2.6	explain the purpose of how to use identification codes			
		3.1	explain where different methods of communication would be used within the automotive environment			
		3.2	explain the factors which can determine your choice of communication			
		3.3	explain how the communication of information can change with the target audience to include uninformed and informed people			
4	Understand communication requirements when carrying out vehicle repairs in the automotive work environment	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			
5	Understand how to develop good working relationships with colleagues and customers in the automotive workplace	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_



## Unit 4: Skills in Supporting Job Roles in the Automotive Work Environment

Unit reference number: J/601/6262

QCF level: Level 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy. produce witness testimony from your peers **and** supervisor **or** tutor that you have worked well with others
- 4 produce evidence carrying out the above whilst performing your normal duties.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work effectively within the organisational structure of the automotive work environment	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			
2	Be able to obtain and use information in order to support their job role within the automotive work environment	2.1	select and use legal and technical information, in an automotive work environment			
3	Be able to communicate with and support colleagues and customers effectively within the automotive work environment	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			
4	Be able to develop and keep good working relationships in the automotive work environment	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_



## **Unit 5: Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment**

**Unit reference number:** K/601/6237

**QCF level:** Level 2

**Credit value:** 4

**Guided learning hours:** 40

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### **Unit Summary**

This unit enables the learner to develop an understanding of:

- the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment
- the correct preparation and use of common automotive environment equipment
- the correct selection and fabrication of materials used when modifying and repairing
- the correct application of automotive engineering fabrication and fitting principles.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### **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 workplace. To include:**

- a rule/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

**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

**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 (inc. GRP)
- 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to select, use and care for hand tools and measuring devices in the automotive environment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date	
2	Understand how to prepare and use common workshop equipment	2.1	describe the preparation and safe use of workshop equipment				
		2.2	explain the term: safe working load				
3	Understand how to select materials when fabricating, modifying and repairing vehicles and fitting components	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				
4	Understand how to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	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: a gaskets and seals b sealants and adhesives c fittings and fasteners d electrical circuit components				
4.4	identify locking, fastening and fixing devices						
4.5	state the importance of correct operating specifications for limits, fits and tolerances in the automotive environment						

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 6: Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment

Unit reference number: Y/601/6279

QCF level: Level 2

Credit value: 7

Guided learning hours: 60

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### Unit Summary

This unit helps the learner to develop the skills required for:

- the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment
- the correct preparation and use of common work environment equipment
- the correct selection and fabrication of materials used when modifying and repairing
- the correct application of automotive engineering fabrication and fitting principles.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (Annexe C).

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as detailed below:

#### You must

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of undertaking basic routine checks of hand tools, measuring devices and workshop equipment covering all of those listed below:
  - a electrical
  - b mechanical
  - c pneumatic
  - d hydraulic

- 5 produce evidence of fabricating **at least 1 item** from suitable materials to known tolerances, which includes the following processes:
  - a filing
  - b tapping threads
  - c cutting
  - d drilling
  - e joining
  
- 6 be observed by your assessor carrying out routine checks and during stages of fabrication.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to select, maintain and use and hand tools and measuring devices in the automotive environment	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			
2	Be able to prepare and use common workshop equipment	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			
3	Be able to select materials when fabricating, modifying and repairing vehicles and fitting components	3.1	select and use appropriate materials whilst constructing, fitting, modifying or repairing vehicles and components			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	4.1	use correct procedures when: a filing b tapping threads c cutting plastics and metals d drilling plastics and metals e fitting			
		4.2	use appropriate techniques when fabricating, repairing and modifying vehicles and components			
		4.3	select and use: a gaskets b seals c sealants d fittings and fasteners			
		4.4	apply modification and repair techniques to automotive electrical circuits			
		4.5	select and use locking, fixing and fastening devices			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## Unit 7: Competency in Health, Safety and Good Housekeeping in the Automotive Environment

Unit reference number: A/601/6338

QCF level: Level 2

Credit value: 7

Guided learning hours: 60

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### Unit Summary

This unit will enable the learner to develop competency in order to:

- carry out day to day work area cleaning, clearing away, dealing with spillages and disposal of waste, used materials and debris
- identify hazards and risks in the automotive environment and complying with relevant legislation and good practice
- work safely at all times within the automotive environment, both as an individual and with others.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of use of personal and vehicle protection, cleaning the work environment and disposal of waste on **3** separate **occasions**
- 5 be observed by your assessor on at least **1** occasion carrying out the above

- 6 produce evidence of identifying risks which may result from at least **2** of the items listed below:
  - a the use and maintenance of machinery or equipment
  - b the use of materials or substances
  - c working practices which do not conform to laid down policies
  - d unsafe behaviour
  - e accidental breakages and spillages
  - f environmental factors
- 7 be observed by your assessor on at least **1** occasion carrying out the above
- 8 produce evidence of following at least **4** of the workplace policies listed below:
  - a the use of safe working methods and equipment
  - b the safe use of hazardous substances
  - c smoking, eating, drinking and drugs
  - d what to do in the event of an emergency
  - e personal presentation
- 9 be observed by your assessor following workplace policies on at least **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria	Evidence type	Portfolio reference	Date
1	Be able to use correct personal and vehicle protection within the automotive environment	1.1	select and use personal protective equipment throughout activities. To include appropriate protection of: a eyes b ears c head d skin e feet f hands g lungs		
		1.2	select and use vehicle protective equipment throughout all activities		
2	Be able to carry out effective housekeeping practices in the automotive environment	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 manufacturer's 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		

Learning outcomes		Assessment criteria			Evidence type	Portfolio reference	Date
		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				
3	Be able to recognise and deal with dangers in order to work safely within the automotive workplace	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				
4	Be able to conduct themselves responsibly	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				

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
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Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
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(if sampled)



## Unit 8: Competency in Supporting Job Roles in the Automotive Work Environment

Unit reference number: K/601/6366

QCF level: Level 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit will help the learner develop competency in order to keep good working relationships with all colleagues and customers in the automotive work environment by using effective communication and support.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence that you have worked well with others in the automotive industry
- 5 be observed by your assessor on at least **3** occasions carrying out the above whilst performing your normal work duties.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work effectively within the organisational structure of the automotive work environment	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			
2	Be able to obtain and use information in order to support their job role within the automotive work environment	2.1	select and use legal and manufacturers information, in an automotive work environment			
		3.1	use methods of communication with customers and colleagues which meet their needs			
3	Be able to communicate with and support colleagues and customers effectively within the automotive work environment	3.2	give customers and colleagues accurate information			
		3.3	make requests for assistance from or to customers and colleagues clearly and courteously			
		3.4	report any anticipated delays in completion to the relevant persons promptly			
4	Be able to develop and keep good working relationships in the automotive work environment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		4.3	make and keep achievable commitments to customers and colleagues			
		4.4	inform colleagues promptly of anything likely to affect their own work			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

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*(if sampled)*



## Unit 9: Knowledge of Conducting Routine Heavy Vehicle Maintenance

Unit reference number: J/601/4933

QCF level: 2

Credit value: 2

Guided learning hours: 20

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### Unit Summary

This unit enables the learner to develop knowledge in order to conduct routine maintenance, adjustment and replacement activities as part of the servicing of heavy vehicles.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### Vehicle maintenance, adjustment and record findings

- a vehicle inspection techniques used in routine maintenance including:
  - 1 aural
  - 2 visual and functional assessments on:
    - i engine systems
    - ii chassis systems
    - iii wheels and tyres
    - iv transmission system
    - v electrical and electronic systems
    - vi exterior vehicle body
    - vii vehicle interior
- b the procedures used for inspecting the condition and serviceability of the following:
  - i filters
  - ii drive belts
  - iii wiper blades
  - iv brake linings
  - v pads
  - vi lights

- c preparation and appropriate use of equipment to include:
  - i test instruments
  - ii emission equipment
  - iii wheel alignment
  - iv beam setting equipment
  - v tyre tread depth gauges
  
- d procedures for checking and replenishing where applicable:
  - i oil (engine, gearbox, final drive, hub reduction)
  - ii water (coolant and screenwash)
  - iii hydraulic fluids (brake and clutch)
  - iv engine emission additives (urea)
  - v pneumatic systems
  
- e procedures for replacement of lubricants and filters (to include chassis systems):
  - i replace oil filters
  - ii types of oil
  - iii cleanliness
  - iv disposal of old oil and filters
  
- f procedures for carrying out adjustments on vehicle systems or components:
  - i clearances
  - ii settings
  - iii alignment
  - iv operational performance (engine idle, exhaust gas)
  
- g procedures for checking electrical systems:
  - i operation
  - ii security
  - iii performance
  
- h importance and process of detailed inspection procedures:
  - i following inspection checklists
  - ii checking conformity to manufacturer's specifications
  - iii legal requirements as applicable
  
- i importance and process of completing all relevant documentation relating to routine maintenance:
  - i inspection records
  - ii job cards
  - iii vehicle repair records
  - iv in-vehicle service history

**The need to use vehicle protection prior to repair**

- a requirements and methods used for protecting:
  - i vehicle body panels
  - ii paint surfaces
  - iii seats
  - iv interior floor protection

**The need to check the vehicle following routine maintenance**

- a the need to inspect the vehicle following routine maintenance:
  - i professional presentation of vehicle
  - ii customer perceptions
- b the basic checks of vehicle following routine maintenance:
  - i removal of oil and grease marks
  - ii body panels
  - iii paint surfaces
  - iv seats
  - v interior floor protection
  - vi re-instatement of components

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to carry out routine heavy vehicle maintenance	1.1	explain how to conduct a scheduled heavy vehicle routine examination and assessment against the vehicle manufacturers specification			
		1.2	identify the assessment methods used to check for conformity			
		1.3	identify the different systems to be inspected while carrying out heavy vehicle routine maintenance			
		1.4	describe the procedures used for checking the condition and serviceability of heavy vehicle units and components			
		1.5	describe the procedures for checking and replenishing fluid levels			
		1.6	describe the procedures for the replacement of lubricants and fluids			
		1.7	identify adjustments that need to be carried out on a heavy vehicle routine maintenance			
		1.8	explain the procedure for reporting cosmetic damage to vehicle components and units outside normal service items			
		1.9	identify the operating specifications for the systems being checked while carrying out heavy vehicle routine maintenance			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
2	Understand the legal requirements applicable to carrying out heavy vehicle maintenance	2.1	describe the requirements of heavy vehicle maintenance arrangements as part of the operator licence criteria			
		2.2	describe the legal requirement relating to the retention of heavy vehicle maintenance records			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

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(if sampled)



## Unit 10: Skills Required to Conduct Routine Heavy Vehicle Maintenance

Unit reference number: K/601/4973

QCF level: 2

Credit value: 3

Guided learning hours: 20

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### Unit Summary

This unit allows the learner to demonstrate skills in order to carry out heavy vehicle routine maintenance, adjustments and replacement activities as part of the servicing of vehicles.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out servicing activities based on routine checks and inspections on **at least 1 vehicle** which **must** cover the Learning Outcomes.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle routine maintenance	1.1	use suitable personal protective equipment and vehicle coverings throughout when carrying out heavy vehicle routine maintenance			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle routine maintenance activities including: a vehicle technical data b maintenance procedures c legal requirements			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for carrying out routine maintenance			
		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 routine maintenance			

Learning outcomes	Assessment criteria		Evidence type	Portfolio reference	Date
4 Be able to carry out heavy vehicle routine maintenance	4.1	carry out heavy vehicle maintenance using prescribed methods, adhering to the correct 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> </ul>			
	4.2	carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer's current specification for: <ul style="list-style-type: none"> <li>a the particular service interval</li> <li>b working methods and procedures</li> <li>c use of equipment</li> <li>d the tolerances for the vehicle</li> </ul>			
	4.3	ensure the examination methods identify accurately any vehicle system and or component problems falling outside the maintenance schedule are specified			
	4.4	ensure that the vehicle conforms to the vehicle operating specification and any legal requirements			
	4.5	ensure any comparison of the vehicle against specification accurately identifies any: <ul style="list-style-type: none"> <li>a differences from the vehicle specification</li> <li>b vehicle appearance and condition faults</li> </ul>			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		4.6	use suitable testing methods to evaluate the performance of all replaced and adjusted components and systems accurately			
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
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Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

# Unit 11: Knowledge of Heavy Vehicle Engine Mechanical, Lubrication and Cooling System Units and Components

Unit reference number: D/601/4937

QCF level: 2

Credit value: 3

Guided learning hours: 20

## Unit Summary

This unit enables the learner to develop knowledge in order to carry out the construction and operation of common engine mechanical, lubrication and cooling systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

## Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

## Engines

- a engine types and configurations:
  - i inline
  - ii flat
  - iii vee
  - iv four-stroke cycle for compression ignition engines
  - v naturally aspirated, turbo-charged and turbo-charged aftercooled engines
  - vi alternative fuel engines
  - vii hybrid arrangements where applicable
  
- b key engineering principles related to engine mechanical systems
  - i compression ratios
  - ii volumetric efficiency
  - iii cylinder capacity
  - iv power
  - v torque

- a terms used in engine mechanical systems
  - i TDC
  - ii BDC
  - iii stroke
  - iv bore
  - v relative advantages and disadvantages of different engine types and configurations
  - vi engine components and layouts:
  - vii side camshaft and overhead camshaft
  - viii single and multi cylinder
  - ix wet and dry liners
  - x crankshaft dampers
- b cylinder head layout and design, combustion chamber and piston design
- c calculate compression ratios from given data
- d the procedures used when inspecting engines
- e the procedures to assess:
  - i serviceability
  - ii wear
  - iii condition
  - iv clearances
  - v settings
  - vi linkages
  - vii joints
  - viii fluid systems
  - ix adjustments
  - x operation and functionality
  - xi security
- f symptoms and faults associated with mechanical engine operation:
  - i poor performance
  - ii abnormal or excessive mechanical noise
  - iii erratic running
  - iv low power
  - v exhaust emissions
  - vi abnormal exhaust smoke
  - vii unable to start
  - viii exhaust gas leaks to cooling system
  - ix exhaust gas leaks

### **Lubrication**

- a key engineering principles relating to lubrication systems
  - i classification of lubricants
  - ii properties of lubricants
  - iii methods of reducing friction
- b the advantages and disadvantages of wet and dry systems

- c engine lubrication system:
  - i splash and pressurised systems
  - ii pumps
  - iii pressure relief valve
  - iv filters
  - v oil ways
  - vi oil coolers
  
- d terms associated with lubrication and engine oil:
  - i full-flow
  - ii hydrodynamic
  - iii boundary
  - iv viscosity
  - v multi-grade
  - vi natural and synthetic oil
  - vii viscosity index
  - viii multi-grade
  
- e the requirements and features of engine oil:
  - i operating temperatures
  - ii pressures
  - iii lubricant grades
  - iv viscosity
  - v multi-grade oil
  - vi additives (detergents, dispersants, anti-oxidants inhibitors, anti-foaming agents, anti-wear)
  - vii synthetic oils
  - viii organic oils
  - ix mineral oils
  
- f symptoms and faults associated with lubrication system
  - i excessive oil consumption
  - ii oil leaks
  - iii oil in water
  - iv low or excessive pressure
  - v oil contamination
  
- g the procedures used when inspecting lubrication system
  
- h the construction and operation of heavy vehicle engine lubrication systems and components, to include:
  - i full flow
  - ii by pass
  - iii wet sump
  - iv dry sump

## Cooling, heating and ventilation

- a key engineering principles relating to engine cooling, heating and ventilation systems
  - i heat transfer
  - ii linear and cubical expansion
  - iii specific heat capacity
  - iv boiling point of liquids
- b procedures used to remove, replace and adjust cooling system components
  - i cooling fans and control devices
  - ii header tanks, radiators and pressure caps
  - iii coolant filters
  - iv heater matrix's and temperature control systems
  - v expansion tanks hoses, clips and pipes
  - vi thermostats impellers and coolant
  - vii ventilation systems
- c the preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
  - i system pressure testers
  - ii pressure cap testers
  - iii anti-freeze testing equipment
  - iv chemical tests for the detection of combustion gas
  - v supplementary coolant additive
- d the layout and construction of internal heater systems
- e the controls and connections within internal heater system
- f symptoms and faults associated with cooling systems:
  - i water leaks
  - ii water in oil
  - iii internal heating system: efficiency, operation, leaks, controls, air filtration, air leaks and contamination
  - iv excessively low or high coolant temperature
- g the procedures used when inspecting
  - i internal heating system
  - ii cooling system

## General

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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how the main heavy vehicle engine mechanical systems operate	1.1	identify heavy vehicle engine mechanical system components			
		1.2	describe the construction and operation of heavy vehicle compression ignition engine mechanical systems			
		1.3	compare key heavy vehicle engine mechanical system components and assemblies against alternatives to identify differences in construction and operation			
		1.4	identify the key engineering principles that are related to heavy vehicle engine mechanical systems a compression ratio's b cylinder capacity c power d torque			
		1.5	state common terms used in heavy vehicle engine mechanical systems a TDC b BDC c stroke d bore			
2	Understand how heavy vehicle engine lubrication systems operate	2.1	identify heavy vehicle engine lubrication system components			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand how heavy vehicle engine cooling, heating and ventilation systems operate	2.2	describe the construction and operation of heavy vehicle engine lubrication system components			
		2.3	compare key heavy vehicle engine lubrication system components and assemblies to identify differences in construction and operation			
		2.4	identify the key engineering principles that are related to heavy vehicle engine lubrication systems <ul style="list-style-type: none"> <li>a classification of lubricants</li> <li>b properties of lubricants</li> <li>c methods of reducing friction</li> </ul>			
		2.5	state common terms used in heavy vehicle engine lubrication system design			
		3.1	identify heavy vehicle engine cooling, heating and ventilation system components			
		3.2	describe the construction and operation of heavy vehicle engine cooling, heating and ventilation systems			
		3.3	compare key heavy vehicle engine cooling, heating and ventilation system components and assemblies against alternatives to identify differences in construction and operation			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Understand how to check, replace and test engine mechanical, lubrication and cooling systems system units and components	3.4	<p>identify the key engineering principles that are related to heavy vehicle engine cooling, heating and ventilation systems</p> <ul style="list-style-type: none"> <li>a heat transfer</li> <li>b linear and cubical expansion</li> <li>c specific heat capacity</li> <li>d boiling point of liquids</li> </ul>			
		3.5	state common terms used in key heavy vehicle engine cooling, heating and ventilation system design			
		4.1	describe how to remove and replace engine mechanical, lubrication and cooling system units and components			
		4.2	describe common types of testing methods used to check the operation of engine mechanical, lubrication and cooling systems and their purpose			
		4.3	describe how to test and evaluate the performance of replacement units against vehicle specification			
		4.4	identify common faults found in heavy vehicle engine mechanical, lubrication and cooling systems and their causes			

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## Unit 12: Knowledge of Heavy Vehicle Fuel, Air Supply and Exhaust System Units and Components

Unit reference number: T/601/4944

QCF level: 2

Credit value: 3

Guided learning hours: 20

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### Unit Summary

This unit enables the learner to develop knowledge in order to carry out the construction and operation of common fuel, air and exhaust systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **Mechanical injection systems**

- a the layout and construction of inline and rotary diesel systems to include governor control
- b the principles and requirements of compression ignition engines
  - i combustion chambers (direct and indirect injection)
- c the function and operation of diesel fuel injection components:
  - i fuel filters
  - ii sedimenters
  - iii injector types (direct and indirect injection)
  - iv fuel pipes
  - v cold start systems
  - vi manifold heaters
  - vii fuel cut-off systems

### **Electronic diesel control**

- a the function and operation of common Electronic Diesel Control components:
  - i air mass sensor
  - ii throttle potentiometer
  - iii idle speed control
  - iv coolant sensor
  - v fuel pressure sensor
  - vi flywheel and camshaft sensors
  - vii electronic control units

### **Electronic common rail systems**

- a the layout and construction of common rail diesel systems
- b the function and operation of common rail diesel fuel injection components:
  - i low and high pressure pumps
  - ii rail pressure regulator
  - iii rail pressure sensor
  - iv electronic injector

### **Electronic unit injector systems**

- a the layout and construction of Electronic Unit Injector diesel systems
- b the function and operation of Electronic Unit Injector diesel fuel injection components:
  - i low pressure pump
  - ii electronic unit injector

### **Forced induction**

- a the purpose, construction and operation of:
  - i superchargers
  - ii turbochargers
    - 1) waste-gate controlled
    - 2) variable geometry
  - iii after-coolers
- b explain the procedures for injection pump timing and bleeding the system
- c the procedures used when inspecting the diesel system

### **Fuel**

- a key engineering principles related to engine fuel systems:
  - i properties of fuels
  - ii combustion processes
  - iii exhaust gas constituents
- b the meaning of terms related to:
  - i hydro-carbon fuels
  - ii volatility
  - iii calorific value
  - iv flash point
  - v cetane value

- c the composition of hydro-carbon fuels:
  - i % hydrogen and carbon in compression ignition fuels
- d the composition of air
- e symptoms and faults associated with diesel fuel systems
  - i air in fuel system, water in fuel, filter blockage leaks, difficult starting, erratic running, excessive smoke(black, blue, white), engine knock, turbocharger, faults

### **Air supply and exhaust systems**

- a the construction and purpose of air filtration systems
- b the operating principles of air filtration systems
- c the construction and operation of air supply and exhaust systems to include:
  - i supercharging
  - ii turbo charging
- d the construction and purpose of the exhaust emission control systems including:
  - i exhaust gas recirculation (EGR)
  - ii selective catalytic reduction (SCR)
  - iii particulate trap (filter)
- e the operating principles of the systems
- f exhaust system design to include silencers and vertical stacks
- g the procedures used when inspecting induction, air filtration and exhaust systems
- h symptoms and faults associated with air and exhaust systems
  - i exhaust gas leaks
  - ii air leaks
- i regulated pollutants to include:
  - i hydrocarbons (HC)
  - ii particulate matter (PM)
  - iii oxides of nitrogen (NOx)
  - iv carbon monoxide (CO)
- j key principles in exhaust emission control systems to include:
  - i flame travel
  - ii injection timing
  - iii fuel pressure
  - iv combustion chamber design

## **General**

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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria			Evidence type	Portfolio reference	Date
1	Understand how heavy vehicle engine fuel systems operate	1.1	identify heavy vehicle engine fuel system components				
		1.2	describe the construction and operation of heavy vehicle engine fuel systems				
		1.3	compare key heavy vehicle engine fuel system components and assemblies against alternatives to identify differences in construction and operation				
		1.4	identify the key engineering principles that are related to heavy vehicle engine fuel systems a properties of fuels b combustion processes c exhaust gas constituents				
		1.5	state common terms used in heavy vehicle engine fuel system design				
2	Understand the legal requirements relating to European Emission Standards applicable to commercial vehicles	2.1	describe legal requirements relating to the production of exhaust emissions from heavy vehicle engines (EU requirements)				
		2.2	describe the effects of regulated pollutants				
3	Understand how heavy vehicle exhaust emission control systems operate	3.1	identify heavy vehicle exhaust emission control system components				
		3.2	describe the construction and operation of heavy vehicle exhaust emission control systems				

Learning outcomes	Assessment criteria		Evidence type	Portfolio reference	Date
	3.3	compare key heavy vehicle exhaust emission control system components and assemblies against alternatives to identify differences in construction and operation			
	3.4	identify the key engineering principles that are related to heavy vehicle exhaust emission control systems a flame travel b injection timing c fuel pressure d combustion chamber design			
	3.5	state common terms used in key heavy vehicle engine exhaust emission control design			
4 Understand how heavy vehicle engine air supply and exhaust systems operate	4.1	identify heavy vehicle engine air supply and exhaust system components			
	4.2	describe the construction and operation of heavy vehicle engine air supply and exhaust systems			
	4.3	identify the key engineering principles that are related to heavy vehicle engine air supply and exhaust systems a sound absorption b reduction of harmful emissions			
	4.4	state common terms used in key heavy vehicle engine air supply and exhaust system design			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Understand how to check, replace and test engine fuel, air supply and exhaust system units and components	5.1	describe how to remove and replace engine fuel, air supply and exhaust system units and components			
		5.2	describe common types of testing methods used to check the operation of engine fuel, air supply and exhaust system systems and their purpose			
		5.3	explain how to evaluate the performance of replacement units against vehicle specification			
		5.4	explain common faults found in heavy vehicle fuel, air supply and exhaust systems and their causes			

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## Unit 13: Skills Required to Remove and Replace Heavy Vehicle Engine Units and Components

Unit reference number: A/601/4976

QCF level: 2

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills to move and replace heavy vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out the removal and replacement of engine mechanical units and components from **3 different systems out of the 5 listed below not** including standard external filters:
  - a engine mechanical systems
  - b cooling systems
  - c air supply and exhaust systems
  - d fuel systems
  - e lubrication systems

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on 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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle engine unit and component removal and replacement activities including: a vehicle technical data b removal and replacement procedures c legal requirements			
		2.2	use technical information to support heavy vehicle engine unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle engine 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 remove and replace heavy vehicle engine systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out removal and replacement of heavy vehicle engine units and components.	4.1	remove and replace the heavy vehicle's engine systems and components, adhering to the specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements			
		4.2	ensure that replaced heavy vehicle engine units and components conform to the vehicle operating specification and any legal requirements			
		4.3	use suitable testing methods to evaluate the performance of the reassembled system			
		4.4	ensure that the reassembled heavy vehicle engine systems performs to the vehicle operating specification and meets any legal requirements			
5	Be able to record information and make suitable recommendations	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			

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Date: \_\_\_\_\_

# Unit 14: Knowledge of Removing and Replacing Heavy Vehicle Electrical Units and Components

Unit reference number: J/601/4947

QCF level: 2

Credit value: 6

Guided learning hours: 45

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## Unit Summary

This unit enables the learner to develop knowledge of the principles, construction and operation and testing methods of common electrical and electronic systems and components found on heavy vehicles.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### Electrical and electronic principles

- a electrical units:
  - i volt (electrical pressure)
  - ii ampere (electrical current)
  - iii ohm (electrical resistance)
  - iv watt (power)
- b the requirements for an electrical circuit:
  - i battery
  - ii cables
  - iii switch
  - iv current consuming device
  - v continuity
- c the direction of current flow and electron flow
- d series and parallel circuits to include:
  - i current flow
  - ii voltage
  - iii volt drop
  - iv resistance
  - v the effect on circuit operation of open circuit component(s)
- e earth and insulated return systems
- f cable sizes and colour codes
- g different types of connectors, terminals and circuit protection devices
- h common electrical and electronic symbols

- i the meaning of:
  - i short circuit
  - ii open circuit
  - iii bad earth
  - iv high resistance
  - v electrical capacity
- j the principles of vehicle electronic systems and component
- k interpret vehicle wiring diagrams to include:
  - i vehicle lighting
  - ii auxiliary circuits
  - iii indicators
  - iv starting and charging systems
- l function and construction of electrical components including:
  - i circuit relays
  - ii bulb types including led's and alternative lighting systems
  - iii fan and heater
  - iv circuit protection
- m the safety precautions when working on electrical and electronic systems to include:
  - i disconnection and connection of battery
  - ii avoidance of short circuits
  - iii power surges
  - iv prevention of electric shock
  - v protection of electrical and electronic components
  - vi protection of circuits from overload or damage
- n the set-up and use of:
  - i digital and analogue multi-meters
  - ii voltmeter
  - iii ammeter
  - iv ohmmeter
  - v oscilloscope
  - vi manufacturer's dedicated test equipment
- o electrical and electronic checks for electrical and electronic systems to include:
  - i connections
  - ii security
  - iii functionality
  - iv performance to specifications
  - v continuity, open circuit
  - vi short circuit
  - vii high resistance
  - viii volt drop
  - ix current consumption
  - x output patterns (oscilloscope)

- p symptoms and faults associated with electrical and electronic systems to include:
  - i high resistance
  - ii loose and corroded connections
  - iii short circuit
  - iv excessive current consumption
  - v open circuit
  - vi malfunction
  - vii poor performance
  - viii battery faults to include flat battery
  - ix failure to hold charge
  - x low state of charge
  - xi overheating
  - xii poor starting

### **Battery and Charging**

- a the construction and operation of vehicle batteries including:
  - i low maintenance and maintenance free
  - ii battery cell construction
- 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 axial and pre-engaged starter motor
  - ii starter ring gear
  - iii starter solenoid
  - iv ignition/starter switch
  - v starter relay
  - vi one-way clutch (pre-engaged starter motor)

### **Lighting**

- a function and construction of electrical components including:
  - i front, tail and number plate lamps
  - ii main and dip beam headlamps
  - iii fog and spot lamps
  - iv lighting switches including main/dip switch
  - v directional indicators
  - vi hazard warning

- b the circuit diagram and operation of components for:
  - i side tail and marker lamps
  - ii headlamps
  - iii interior lamps
  - iv fog, high-intensity rear and spot lamps
  - v direction indicators
- c the statutory requirements for vehicle lighting when using a vehicle on the road
- d headlamp adjustment and beam setting

### **Auxiliary systems**

- a auxiliary systems to include:
  - i lighting
  - ii wiper
  - iii security and alarm
  - iv comfort and convenience
  - v information and entertainment
  - vi telephone and two way communication
  - vii electric window
- b function and construction of electrical components including:
  - i central door locking
  - ii anti theft devices
  - iii manual locking and dead lock systems
  - iv window winding
  - v demisting systems
  - vi door mirror operation mechanisms
  - vii interior lights and switching
- c the circuit diagram and operation of components for:
  - i central door locking
  - ii anti theft devices
  - iii manual locking and dead lock systems
  - iv window winding
  - v demisting systems
  - vi door mirror operation mechanisms
- d comfort and convenience systems to include:
  - i heated seats
  - ii electrically adjusted seats
  - iii heated screens
  - iv electric mirrors
  - v heating
  - vi climate control
  - vii air conditioning
  - viii monitoring and instrumentation

## General

- 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria			Evidence type	Portfolio reference	Date
1	Understand heavy vehicle electrical and electronic principles	1.1	identify electrical symbols and units found in heavy vehicle circuits				
		1.2	describe how to interpret heavy vehicle wiring diagrams				
		1.3	describe the operation of key heavy vehicle circuit protection devices and why these are necessary				
		1.4	describe earthing principles and earthing methods				
		1.5	identify the use of different cables and connectors used in heavy vehicle circuits				
		1.6	describe the operation of electrical and electronic sensors and actuators and their application				
		1.7	describe the key electrical and electronic control principles that are related to heavy vehicle electrical circuits				
		1.8	state common terms used in heavy vehicle electrical circuits				
2	Understand how heavy vehicle batteries, starting and charging systems operate	2.1	identify heavy vehicle batteries, starting and charging system components				
		2.2	describe the construction and operation of heavy vehicle batteries, starting and charging system components				

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand how heavy vehicle auxiliary electrical systems operate	2.3	describe how to remove and replace batteries, starting and charging system units and components			
		2.4	compare heavy vehicle batteries, starting and charging system components and assemblies against alternatives to identify differences in construction and operation			
		2.5	state common terms used in conjunction with heavy vehicle batteries, starting and charging systems			
		3.1	identify heavy vehicle auxiliary system components			
		3.2	describe the construction and operation of heavy vehicle auxiliary systems			
4	Understand how to check, replace and test heavy vehicle electrical systems and components	3.3	compare key heavy vehicle auxiliary system components and assemblies against alternatives to identify differences in construction and operation			
		3.4	state common terms used in heavy vehicle auxiliary system design			
		4.1	describe how to remove and replace heavy vehicle electrical system units and components			
		4.2	describe common types of testing methods used to check the operation of heavy vehicle electrical systems and components and their purpose			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		4.3	explain how to test and evaluate the performance of replacement units against specifications			
		4.4	explain common faults found in heavy vehicle electrical systems and components			

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## Unit 15: Skills Required to Remove and Replace Heavy Vehicle Electrical Units and Components

Unit reference number: F/601/4977

QCF level: 2

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order to remove and replace motor vehicle electrical system components. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of carrying out the removal and replacement of vehicle electrical units and components from:
  - a engine starting systems
  - b engine charging systems

**Plus** 2 different systems out of the 8 listed below:

- a lighting
- b wiper
- c security and alarm
- d comfort and convenience
- e information and entertainment
- f telephone and two-way communication
- g electric window systems
- h monitoring and instrumentation systems

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on heavy vehicle electrical systems and components			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle electrical unit and component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle electrical unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of motor vehicle electrical systems components			
		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 remove and replace motor vehicle electrical systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out removal and replacement of heavy vehicle electrical units and components.	4.1	remove and replace the motor vehicle's electrical systems and components, adhering to the specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements			
		4.2	ensure that replaced motor vehicle electrical units and components conform to the vehicle operating specification and any legal requirements			
		4.3	use suitable testing methods to evaluate the performance of the reassembled system			
		4.4	ensure that the reassembled motor vehicle electrical systems perform to the vehicle operating specification and meets any legal requirements			
5	Be able to record information and make suitable recommendations	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			

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(if sampled)

## **Unit 16: Knowledge of Heavy Vehicle Removing and Replacing Chassis Units and Components**

**Unit reference number:** L/601/4951

**QCF level:** 2

**Credit value:** 6

**Guided learning hours:** 45

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### **Unit Summary**

This unit enables the learner to develop an understanding of the construction and operation of common steering, suspension and braking systems (including wheels and tyres) on heavy vehicles. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **Chassis layouts**

- a types of chassis
- b axle configurations
- c rear steered axles
- d self-steered axles

#### **Steering**

- a key engineering principles related to steering:
  - i geometry
  - ii angles
  - iii damping
  - iv stress and strain
- b the construction and operation of steering systems:
  - i power and non-assisted steering
  - ii multi axle steering arrangements
  - iii heavy vehicle steering units and components

- c the action and purpose of steering geometry:
  - i castor angle
  - ii camber angle
  - iii kingpin or swivel pin inclination
  - iv negative offset
  - v wheel alignment (tracking) (toe in and toe out)
  - vi toe out on turns
  - vii steered wheel geometry
  - viii multi axle steered wheel geometry
- d the following terms associated with steering:
  - i Ackerman principle
  - ii slip angles
  - iii self-aligning torque oversteer and understeer
  - iv neutral steer
  - v rear steer
  - vi self-steer
- e the components and layout of hydraulic power assisted steering systems:
  - i piston and power cylinders
  - ii drive belts and pumps
  - iii control valve (rotary, spool and flapper type)
  - iv hydraulic fluid
- f the advantages of power assisted steering
- g the operation of hydraulic power assisted steering
- h the principles of electronic power steering systems
- i the procedures used for inspecting the serviceability and condition of:
  - i manual steering
  - ii power assisted steering
- j steering system defects to include:
  - i uneven tyre wear
  - ii wear on outer edge of tyre
  - iii wear on inner edge of tyre
  - iv uneven wear
  - v flats on tread
  - vi steering vibrations
  - vii wear in linkage
  - viii damaged linkage
  - ix incorrect wheel alignment
  - x incorrect steering geometry

## Suspension

- a types of suspension
  - i non independent suspension
  - ii independent suspension
  - iii air suspension
  - iv electronically controlled air suspension (ECAS)
  - v steel suspension
  - vi lifting axles
  
- b the layout and components of suspension systems:
  - i non-independent suspensions
  - ii independent front suspension (IFS)
  - iii air suspension
  - iv electronically controlled air suspension (ECAS)
  - v rubber suspension
  - vi tandem axle suspension
  - vii lifting axles
  
- c the operation of suspension systems and components:
  - i leaf and coil springs
  - ii torsion bar
  - iii air springs
  - iv air suspension levelling mechanism (mechanical and electronic)
  - v dampers
  - vi trailing arms
  - vii ball joints
  - viii bump stops
  - ix anti-roll bars
  - x stabiliser bars
  - xi swinging arms
  - xii parallel link
  - xiii transverse link
  - xiv "A" frame axle location
  - xv suspension damping
  - xvi stress and strain
  
- d the advantages of different systems including:
  - i non-independent
  - ii independent suspension (IFS)
  - iii air suspension (mechanical)
  - iv air suspension (electronically controlled)
  - v lifting axles
  
- e the principles of electronically controlled air suspensions systems
  
- f the forces acting on suspension systems during braking, driving and cornering
  
- g the methods of locating the road wheels against braking, driving and cornering forces
  
- h the methods of controlling cornering forces by fitting anti-roll torsion members

- i suspension terms:
  - i rebound
  - ii bump
  - iii yaw
  - iv dive
  - v pitch
  - vi roll
  - vii compliance
- j the procedures used for inspecting the serviceability and condition of the suspension system
- k suspension system defects:
  - i wheel hop
  - ii ride height (unequal and low)
  - iii wear
  - iv noises under operation
  - v fluid leakage
  - vi excessive travel
  - vii excessive tyre wear
  - viii bounce
  - ix poor vehicle handling
  - x worn dampers
  - xi worn joints
  - xii damaged linkages
  - xiii vehicle "crabbing"

## **Brakes**

- a key principles relating to braking systems:
  - i laws of friction
  - ii hydraulics
  - iii pneumatics
  - iv properties of fluids
  - v properties of air
  - vi braking efficiency
- b the construction and operation of braking systems:
  - i air brakes
  - ii air-over-hydraulic brakes
  - iii electronic brakes including anti-lock braking systems and anti-slip regulation
  - iv endurance (retarding) systems

- c the construction and operation of drum brakes:
  - i leading and trailing shoe construction
  - ii self-servo action
  - iii slack adjusters
  - iv cam expanders
  - v wedge expanders
  - vi automatic adjusters
  - vii backing plates
  - viii parking brake system
  - ix wear indicators and warning lamps
  
- d the construction and operation of disc brakes:
  - i disc pads
  - ii caliper
  - iii brake disc
  - iv ventilated disc
  - v disc pad retraction
  - vi parking brake system
  - vii wear indicators and warning lamps
  
- e the construction and operation of the hydraulic braking system:
  - i line layout
  - ii master cylinders
  - iii wheel cylinders
  - iv disc brake caliper & pistons
  - v brake pipe
  - vi brake servo
  - vii warning lights
  - viii parking brakes
  - ix equalising valves
  
- f the construction and operation of the air braking system
  - i air compressors
  - ii air dryers
  - iii air processing units
  - iv pressure regulating valves
  - v circuit protection valves
  - vi air reservoirs
  - vii control valves (foot, park and hand)
  - viii relay valves
  - ix load sensing valves (mechanical and automatic)
  - x brake actuators
  - xi parking brake mechanisms
  - xii trailer control valves
  - xiii two-line trailer brake system
  - xiv warning light/buzzer systems
  - xv air pipes
  - xvi valve port numbering

- g the construction and operation of the air-over-hydraulic braking system
  - i air supply and storage
  - ii air control valves
  - iii conversion from pneumatic pressure to hydraulic pressure
  - i hydraulic control valves
  
- h the requirements and hazards of brake fluid:
  - i boiling point
  - ii hygroscopic action
  - iii manufacturer's change periods
  - iv fluid classification and rating
  - ii potential to damage paint surfaces
  
- i terms associated with braking systems:
  - i braking efficiency
  - ii brake fade
  - iii brake balance
  
- j the procedures used for inspecting the serviceability and condition of the braking system
  
- k braking system defects:
  - iv worn shoes or pads
  - v worn or scored brake surfaces
  - vi abnormal brake noises
  - vii brake judder
  - viii fluid contamination of brake surfaces
  - ix fluid/air leaks
  - x pulling to one side
  - xi poor braking efficiency
  - xii lack of assistance
  - xiii loss of air pressure
  - xiv brake drag
  - xv brake grab
  - xvi brake fade

### **Endurance brakes**

- a the construction and operation of heavy vehicle endurance (retarder) brakes:
  - i exhaust brake
  - ii compression (engine) brake
  - iii hydraulic retarder
  - iv electro-magnetic retarder

## **ABS and ASR**

- a the construction and operation of heavy vehicle ABS systems
  - i category one (2S/2M)
  - ii category two (2S/1M)
  - iii category three (1S/1M)
  - iv wheel speed sensors
  - v modulators
  - vi electronic control unit
- b terms associated with ABS systems
  - i individual control
  - ii modified individual control
  - iii select low
- c the construction and operation of heavy vehicle ASR systems
- d the procedures used for inspecting the serviceability and condition of the ABS/ASR system

## **Wheel and tyres**

- a the engineering principles for wheels and tyres
  - i friction
  - ii un-sprung weight
  - iii dynamic and static balance
- b the construction of different types of tyre:
  - i radial
  - ii cross ply
  - iii bias belted
  - iv tread patterns
  - v tyre mixing regulations
  - vi tyre applications
  - vii tyre markings
  - viii wheel construction
- c tyre markings:
  - i tyre and wheel size markings
  - ii speed rating
  - iii direction of rotation
  - iv profile
  - v load rating
  - vi ply rating
  - vii tread-wear indicators

- d wheel construction:
  - i alloy
  - ii pressed steel
  - iii one-piece rims
  - iv two-piece rims
  - v three-piece rims
- e wheel retention
  - i conical seating
  - ii spherical seating
  - iii spigot mounted
- f types of wheel bearing arrangements:
  - i non-driving and driven wheels
  - ii fully floating
  - iii three quarter floating
- g types of bearing used for wheel bearing arrangements and their adjustment:
  - i taper roller
  - ii angular contact ball
  - iii integrated
- h the procedures used for inspecting the serviceability and condition of:
  - i tyres & wheels
  - ii bearings
- i the defects associated with tyres and wheels:
  - i abnormal tyre wear
  - ii cuts
  - iii side wall damage
  - iv wheel vibrations
  - v loose wheel retainers
  - vi tyre over heating
  - vii tread separation
- j hazards when loading heavy vehicles
  - i flammable liquids
  - ii Gases that are lighter than air and heavier than air
  - iii increased vehicle mass
  - iv raised tipper bodies
  - v raised centre of gravity
  - vi working at heights

## General

The procedures for dismantling, removal and replacement of chassis system components

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

### Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how heavy vehicle steering systems operate	1.1	identify heavy vehicle steering system components			
		1.2	describe the construction and operation of heavy vehicle steering systems			
		1.3	compare key heavy vehicle steering system components and assemblies against alternatives to identify differences in construction and operation			
		1.4	identify the key engineering principles that are related to heavy vehicle steering systems <ul style="list-style-type: none"> <li>a steering angles</li> <li>b hydraulic forces</li> <li>c stress and strain</li> </ul>			
		1.5	state common terms used in heavy vehicle steering system design			
2	Understand how heavy vehicle suspension systems operate	2.1	identify heavy vehicle suspension system components			
		2.2	describe the construction and operation of heavy vehicle suspension systems			
		2.3	compare key heavy vehicle suspension system components and assemblies against alternatives to identify differences in construction and operation			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand how heavy vehicle braking systems operate	2.4	<p>identify the key engineering principles that are related to heavy vehicle suspension systems</p> <p>a suspension hydraulic damping</p> <p>b stress and strain</p>			
		2.5	state common terms used in heavy vehicle suspension system design			
		3.1	identify heavy vehicle braking system components			
		3.2	describe the construction and operation of heavy vehicle braking systems			
		3.3	compare key heavy vehicle braking system components and assemblies against alternatives to identify differences in construction and operation			
		3.4	<p>identify the key engineering principles that are related to heavy vehicle braking systems</p> <p>a laws of friction</p> <p>b hydraulics</p> <p>c pneumatics</p> <p>d properties of fluids</p> <p>e properties of air</p> <p>f braking efficiency</p>			
		3.5	state common terms used in heavy vehicle braking system design			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Understand how heavy vehicle wheel and tyre systems operate	4.1	identify heavy vehicle wheel and tyre components			
		4.2	describe the construction and operation of heavy vehicle wheels and tyres			
		4.3	compare key heavy vehicle wheel and tyre components and assemblies against alternatives to identify differences in construction and operation			
		4.4	identify the key engineering principles that are related to heavy vehicle wheel and tyre systems a friction b un-sprung weight c dynamic and static balance			
		4.5	state common terms used in heavy vehicle wheel and tyre design			
5	Understand the health and safety aspects when working on loaded vehicles	5.1	identify types of hazards when working on loaded heavy vehicles			
6	Understand how to check, replace and test heavy vehicle chassis units and components	6.1	describe how to remove and replace chassis units and components			
		6.2	describe common types of testing methods used to check the operation of chassis units and components and their purpose			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		6.3	explain how to evaluate the performance of replacement units against vehicle specification			
		6.4	identify common faults found in heavy vehicle chassis units and components			

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## Unit 17: Skills Required to Remove and Replace Heavy Vehicle Chassis Units and Components

Unit reference number: L/601/4979

QCF level: 2

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order to remove and replace heavy vehicle steering, suspension and braking units (including wheels and tyres). It also covers the evaluation of performance of the replaced units and systems

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out the removal and replacement of **2 different units or components** – from 2 of the systems below. Your evidence must include demonstration of skill **in each** aspect of mechanical and hydraulic or pneumatic unit or component removal and replacement
  - a steering
  - b suspension
  - c braking

### Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on heavy vehicle chassis systems and components			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle chassis unit and component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle chassis unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle chassis 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 remove and replace heavy vehicle chassis systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out removal and replacement of heavy vehicle chassis units and components.	4.1	remove and replace the heavy vehicle's chassis systems and components, adhering to the correct specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements.			
		4.2	ensure that replaced heavy vehicle chassis units and components conform to the vehicle operating specification and any legal requirements			
		4.3	use suitable testing methods to evaluate the performance of the reassembled system			
		4.4	ensure that the reassembled heavy vehicle chassis system performs to the vehicle operating specification and meets any legal requirements			
5	Be able to record information and make suitable recommendations	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			

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(if sampled)

## **Unit 18: Knowledge of Heavy Vehicle Transmission and Driveline Units and Components**

**Unit reference number:** F/601/4963

**QCF level:** 2

**Credit value:** 6

**Guided learning hours:** 45

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### **Unit Summary**

This unit enables the learner to develop knowledge of the construction and operation of common transmission and driveline systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### **Key principles related to clutch systems**

- a clutch systems to include:
  - i principles of friction
  - ii principle of levers
  - iii torque transmission

### **The operation of clutch operating systems**

- a clutch operating mechanisms
  - i pedal and lever
  - ii hydraulic operated
  - iii air assisted
  - iv hydraulic components
  - v master cylinder
  - vi slave cylinder
  - vii hydraulic pipes
  - viii electrical and electronic components (fluid level indicators)

### **The operation of friction clutches**

- a the reasons for fitting a clutch
- b the construction and operation of:
  - i coil spring clutches
  - ii diaphragm spring clutches
  - iii single plate clutches
  - iv multi plate clutches
  - v clutch/upshift brakes
- c types of friction materials used in clutch construction:
  - i organic
  - ii ceramic
- d clutch mechanisms
  - i diaphragm spring clutches
  - ii single plate clutches
  - iii multi plate clutches
  - iv air assistance
  - v hydraulic operation

### **Gearbox systems**

- a construction and operation of gearbox systems including:
  - i gearshift control systems
  - ii manual gearbox
  - iii automatic gearbox
- b key principles relating to gearbox systems
  - i gear ratios
  - ii input and output ratios
  - iii torque multiplication

### **The operation of manual gearboxes**

- a the reasons for fitting gearboxes, to provide neutral, reverse, torque multiplication
- b different gearbox types:
  - i single layshaft
  - ii twin layshaft
  - iii range change
  - iv splitter
  - v twin splitter
- c the layout and construction of gears and shafts for 5, 6, 8, 12 and 16 speed gearbox designs, constant mesh and synchromesh gearboxes, reverse gear
- d the construction and operation of:
  - i gear selection linkages
  - ii selector forks and rods
  - iii detents and interlock mechanisms
- e the construction and operation of synchromesh devices

- f the arrangements for gearbox bearings:
  - i bushes
  - ii oil seals
  - iii gaskets
  - iv gearbox lubrication
  - v tachograph drive
- g the electrical and electronic components including reverse lamp switch
- h calculate gear ratios and driving torque for typical gearbox specifications
- i the need to remove the propshaft before towing a casualty vehicle

### **The operation of automatic gearboxes**

- a the reasons for using automatic gearboxes over manual (urban use, stop/start applications)
- b the construction and operation automatic gearboxes to include:
  - i epicyclic geartrain
  - ii brake bands
  - iii fluid couplings and torque converters
- c properties of automatic transmission fluid

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

- a including:
  - i universal couplings
  - ii sliding couplings
  - iii constant velocity joints
  - iv final drive units
  - v propshafts
  - vi split-propshafts
  - vii driveshafts
  - viii hub reduction
  - ix tandem drive axles
- b key principles relating to driveline systems including:
  - i gear ratios
  - ii simple stresses
- c the layout and construction of propshafts and drive shafts used in multi-axle drive systems
- d the reasons for using flexible couplings and sliding joints in transmissions systems
- e the reason for using constant velocity joints in drive shafts incorporating steering mechanisms
- f the construction and operation of:
  - i universal joints
  - ii sliding couplings
  - iii constant velocity joints
  - iv centre bearings

- g the simple stresses applied to shafts: torsional, bending and shear
- h the construction and operation of:
  - i final drive units
  - ii multi-drive axle arrangements
  - iii crown wheel & pinion
  - iv bevel, hypoid and helical gears
  - v differential gears
  - vi lubricants
  - vii lubrication bearings and seals
  - viii differential locks
  - ix epicyclic hub reduction
- i the reasons for fitting differential/s
- j calculate final drive gear ratios
- k calculate the overall gear ratio from given data (gearbox ratio x final drive ratio)

### **The construction and operation of gear selector systems**

- a including:
  - i remote linkages
  - ii servo-assistance
  - iii range change selection
  - iv splitter selection
  - v electronic gear selection
- b the layout and operation of gear selector mechanisms used on heavy vehicles:
  - i manual shift using rods and levers
  - ii manual shift using cables
  - iii manual shift using servo assistance
  - iv range change selection
    - 1) manual switch (gearstick mounted)
    - 2) automatic (gearbox mounted)
  - v splitter selection
- c the layout and operation of electronically controlled gear selector systems:
  - i clutch system
  - ii gear selection
  - iii gear speed synchronisation

### **The testing and inspection techniques used for heavy vehicle transmission systems**

- a the techniques and procedures used for inspecting and testing clutches and clutch mechanisms including:
  - i clearances
  - ii pedal and lever settings
  - iii cables & linkages
  - iv hydraulic system
  - v leaks (fluid and air)
  - vi adjustments
  - vii travel

- b the techniques and procedures used for inspecting and testing gearboxes including:
  - i leaks
  - ii gear selection
  - iii synchromesh operation
  - iv abnormal noise
- c the techniques and procedures used for inspecting and testing drive line systems (prop & drive shafts, couplings and centre bearings) including:
  - i security
  - ii serviceability
  - iii leaks
  - iv alignment
  - v balance weights (where applicable)
- d the techniques used when inspecting and testing final drive systems including:
  - i fluid levels
  - ii leaks
  - iii noise

**The faults and symptoms associated with vehicle transmissions systems**

- a the faults and symptoms associated with transmission systems:
  - i clutch faults
  - ii gearbox faults
  - iii drive line faults (propshaft, drive shaft, universal and constant velocity joints)
  - iv universal joint alignment
  - v final drive faults
  - vi gear selection faults
- b faults and symptoms to include mechanical, electrical and hydraulic systems

**The procedures for dismantling, removal and replacement of transmission units and components**

- a the preparation, testing and use of tools and equipment, electrical meters and equipment used for dismantling removing and replacing transmission systems and components
- b appropriate safety precautions:
  - i PPE
  - ii vehicle protection when dismantling
  - iii removing and replacing transmission systems and components
- c the importance of logical and systematic processes
- d the inspection and testing of transmission systems and components
- e the preparation of replacement units for re-fitting or replacement of transmission systems or components

- f the reasons why replacement components and units must meet the original specifications (OES):
  - i warranty requirements
  - ii to maintain performance
  - iii safety requirements
- g refitting procedures
- h the inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements
- i the inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
  - i cleanliness of vehicle interior and exterior
  - ii security of components and fittings
  - iii re-instatement of components and fittings

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria			Evidence type	Portfolio reference	Date
1	Understand how heavy vehicle clutch systems operate	1.1	identify heavy vehicle clutch system components				
		1.2	describe the construction and operation of heavy vehicle clutch systems				
		1.3	compare key heavy vehicle clutch system components and assemblies against alternatives to identify differences in construction and operation				
		1.4	identify the key engineering principles that are related to heavy vehicle clutch systems <ul style="list-style-type: none"> <li>a principles of friction</li> <li>b principle of levers</li> <li>c torque transmission</li> </ul>				
		1.5	state common terms used in heavy vehicle clutch system design				
2	Understand how heavy vehicle gearbox systems operate	2.1	identify heavy vehicle gearbox system components				
		2.2	describe the construction and operation of heavy vehicle gearbox systems				
		2.3	compare key heavy vehicle gearbox system components and assemblies against alternatives to identify differences in construction and operation				

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date	
3	Understand how heavy vehicle driveline systems operate	2.4	identify the key engineering principles that are related to heavy vehicle gearbox systems a gear ratios b torque multiplication				
		2.5	state common terms used in heavy vehicle manual gearbox system design				
		3.1	identify heavy vehicle driveline component				
		3.2	describe the construction and operation of heavy vehicle driveline systems				
		3.3	compare key heavy vehicle driveline components and assemblies against alternatives to identify differences in construction and operation				
	3.4	identify the key engineering principles that are related to heavy vehicle driveline systems a final drive and overall gear ratios b simple stresses					
	3.5	state common terms used in heavy vehicle driveline design					
	4	Understand how heavy vehicle gear selection mechanisms operate	4.1	identify heavy vehicle gear selection mechanism components			
			4.2	describe the construction and operation of heavy vehicle gear selection systems			
4.3			compare key heavy vehicle gear selection mechanism components and assemblies against alternatives to identify differences in construction and operation				

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		4.4	identify the key engineering principles that are related to heavy vehicle gear selection systems			
		4.5	state common terms used in heavy vehicle gear selection systems			
5	Understand how to check, replace and test transmission and driveline units and components	5.1	describe how to remove and replace transmission and driveline system units and components			
		5.2	describe common types of testing methods used to check the operation of transmission and driveline systems and their purpose			
		5.3	explain how evaluate the performance of replacement units against vehicle specification			
		5.4	identify common faults found in heavy vehicle transmission and driveline systems and their causes			

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## **Unit 19: Knowledge of Inspecting Heavy Vehicles**

**Unit reference number:** Y/601/4967

**QCF level:** 2

**Credit value:** 4

**Guided learning hours:** 40

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### **Unit Summary**

This unit enables the learner to develop knowledge in order to carry out a range of inspections on heavy vehicles using a variety of testing and inspection methods.

#### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to carry out inspections on heavy vehicles using prescribed methods	1.1	<p>explain the difference between the various prescribed heavy vehicle inspection methods to include:</p> <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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
	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				

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## Unit 20: Skills Required to Inspect Heavy Vehicles Using Prescribed Methods

Unit reference number: F/601/4980

QCF level: 2

Credit value: 2

Guided learning hours: 20

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### Unit Summary

This unit allows the learner to demonstrate skills in order to carry out a range of inspections on heavy vehicles using a variety of prescribed testing and inspection methods.

#### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your normal workplace or in a Realistic Work Environment as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out **at least 2** different inspections from the following:
  - a pre-delivery and pre-purchase
  - b daily vehicle checks
  - c pre and post rental inspections
  - d pre and post work inspection

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle inspections using prescribed methods	1.1	use suitable personal protective equipment and vehicle coverings when carrying out heavy vehicle inspections using prescribed methods			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle inspection activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b inspection procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	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-delivery and pre-purchase</li> <li>b daily vehicle checks</li> <li>c pre and post rental inspections</li> </ul>			
		3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		3.3	use the tools and equipment in the way specified by manufacturers when carrying out a range of inspections on heavy vehicle systems			
4	Be able to carry out heavy vehicle inspections using prescribed methods	4.1	carry out heavy vehicle inspections using prescribed methods, 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 prescribed documentation</li> </ul>			
		4.2	ensure that the inspected heavy vehicle conforms to the vehicle operating specification and any legal requirements			
		4.3	ensure any comparison of the vehicle against specification accurately identifies any: <ul style="list-style-type: none"> <li>a differences from the vehicle specification</li> <li>b vehicle appearance and condition faults</li> </ul>			
		4.4	use suitable testing methods to evaluate the performance of the inspected systems			
5	Be able to record information and make suitable recommendations	5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 21: Skills Required to Remove and Replace Heavy Vehicle Transmission and Driveline Units and Components

Unit reference number: J/601/4995

QCF level: 2

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order to remove and replace heavy vehicle transmission and driveline units. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out the removal and replacement of **1 unit or component from 2 of the areas** as listed below:
  - a clutch
  - b gearbox
  - c drive line (shafts, couplings, hubs and bearings)
  - d final drive
- 5 produce evidence of removing and replacing 1 unit or component on 2 separate occasions.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle transmission and driveline system component removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings throughout when working on heavy vehicle transmission and driveline systems			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle transmission and driveline systems			
		3.2	ensure that the equipment has been calibrated to meet manufacturers' and legal requirements			
		3.3	use the tools and equipment in the way specified by manufacturers to remove and replace heavy vehicle transmission and driveline systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out removal and replacement of heavy vehicle transmission and driveline units and components	4.1	remove and replace the heavy vehicle's transmission and driveline systems and components, adhering to the specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements			
		4.2	ensure that replaced heavy vehicle transmission and driveline units and components conform to the vehicle operating specification and any legal requirements			
		4.3	use suitable testing methods to evaluate the performance of the reassembled system			
		4.4	ensure that the reassembled heavy vehicle transmission and driveline system performs to the vehicle operating specification and meets any legal requirements			
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 22: Competency in Conducting Routine Heavy Vehicle Maintenance

Unit reference number:	L/601/4903
QCF level:	2
Credit value:	7
Guided learning hours:	60

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### Unit Summary

This unit will enable the learner to demonstrate competency in carrying out heavy vehicle routine maintenance, adjustments and replacement activities as part of the servicing of vehicles.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of carrying out servicing activities based on routine checks and inspections **at least 3 different vehicles** which **must** collectively cover the Learning Outcomes.
- 5 be observed by your assessor **in your normal workplace** carrying out servicing activities on **at least 1 occasion**.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle routine maintenance	1.1	use suitable personal protective equipment and vehicle coverings throughout when carrying out heavy vehicle routine maintenance			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle routine maintenance activities including: a vehicle technical data b maintenance procedures c legal requirements			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for carrying out routine maintenance			
		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 routine maintenance			

Learning outcomes	Assessment criteria		Evidence type	Portfolio reference	Date
4 Be able to carry out heavy vehicle routine maintenance	4.1	carry out heavy vehicle maintenance using prescribed methods, adhering to the correct 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> </ul>			
	4.2	carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer's current specification for: <ul style="list-style-type: none"> <li>a the particular service interval</li> <li>b working methods and procedures</li> <li>c use of equipment</li> <li>d the tolerances for the vehicle</li> </ul>			
	4.3	ensure the examination methods identify accurately any vehicle system and or component problems falling outside the maintenance schedule are specified			
	4.4	ensure that the vehicle conforms to the vehicle operating specification and any legal requirements			
	4.5	ensure any comparison of the vehicle against specification accurately identifies any: <ul style="list-style-type: none"> <li>a differences from the vehicle specification</li> <li>b vehicle appearance and condition faults</li> </ul>			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	4.6	use suitable testing methods to evaluate the performance of all replaced and adjusted components and systems accurately			
		4.7	complete all system diagnostic activities within the agreed timescales			
		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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 23: Competency in Removing And Replacing Heavy Vehicle Engine Units and Components

Unit reference number: R/601/4904

QCF level: 2

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in removing and replace heavy vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of removing and replacing **at least 1** unit or component from at least **4** of the **5\*** systems listed below. The evidence **must** come from work **in your normal workplace, not** including standard external filters
  - a engine mechanical systems
  - b cooling systems
  - c air supply and exhaust systems
  - d fuel systems
  - e lubrication systems
- 5 be observed by your assessor on at least 1 occasion removing and replacing components or units.
  - \* However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of **all** the systems listed above.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on 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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle engine unit and component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle engine unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle engine 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 remove and replace heavy vehicle engine systems			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
4 Be able to carry out removal and replacement of heavy vehicle engine units and components	<p>4.1 remove and replace the heavy vehicle's engine systems and components, adhering to the specifications and tolerances for the vehicle and following:</p> <ul style="list-style-type: none"> <li>a the manufacturer's approved removal and replacement methods</li> <li>b recognised researched repair methods</li> <li>c health and safety requirements</li> </ul> <p>4.2 ensure that replaced heavy vehicle engine units and components conform to the vehicle operating specification and any legal requirements</p> <p>4.3 use suitable testing methods to evaluate the performance of the reassembled system</p> <p>4.4 ensure that the reassembled heavy vehicle engine systems performs to the vehicle operating specification and meets any legal requirements</p> <p>4.5 complete all system diagnostic activities within the agreed timescale</p>			
5 Be able to record information and make suitable recommendations	<p>5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required</p> <p>5.2 make suitable and justifiable recommendations for cost effective repairs</p> <p>5.3 identify and report any expected delays in completion to the relevant person(s) promptly in the format required</p>			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 24: Competency in Removing And Replacing Heavy Vehicle Electrical Units and Components

Unit reference number: Y/601/4905

QCF level: 2

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in removing and replacing motor vehicle electrical system components. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of removing and replacing **at least 4\*** units or components, **each** from a **different** electrical system listed below. At least **3** of these **4** pieces of evidence **must** come from work **in your normal workplace**
- 5 be observed by your assessor on **at least 1 occasion in your normal workplace** carrying out the removal and replacement of at least **1** of the following\*:
  - a engine starting
  - b battery charging

- 6 be observed by your assessor on **at least 1 occasion in your normal workplace** of successfully carrying out the removal and replacement of electrical units and components \*:
- a lighting
  - b wiper
  - c security and alarm
  - d comfort and convenience
  - e information and entertainment
  - f telephone and two way communication
  - g electric window systems
  - h monitoring and instrumentation systems

\* However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of all the systems listed above.

Simulated activity **will be** acceptable to assess candidates' removal and replacement competence on **no more than 1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on heavy vehicle electrical systems and components			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle electrical unit and component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle electrical unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of motor vehicle electrical 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 remove and replace motor vehicle electrical systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out removal and replacement of heavy vehicle electrical units and components.	4.1	remove and replace the motor vehicle's electrical systems and components, adhering to the specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements			
		4.2	ensure that replaced motor vehicle electrical units and components conform to the vehicle operating specification and any legal requirements			
		4.3	use suitable testing methods to evaluate the performance of the reassembled system			
		4.4	ensure that the reassembled motor vehicle electrical systems performs to the vehicle operating specification and meets any legal requirements			
		4.5	complete all system diagnostic activities within the agreed timescales			
5	Be able to record information and make suitable recommendations	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
	5.3	identify and report any expected delays in completion to the relevant person(s) promptly in the format required				
	5.4	record and report any additional faults noticed during the course of their work promptly in the format required				

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)



## Unit 25: Competency in Removing and Replacing Heavy Vehicle Chassis Units and Components

Unit reference number: M/601/7356

QCF level: 2

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency removing and replacing heavy vehicle steering, suspension and braking units (including wheels and tyres). It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of removing and replacing **3 different units or components** in total which **must include items from** steering, suspension and braking systems. Your evidence must include demonstration of competence **in each** aspect of mechanical, electrical and hydraulic or pneumatic units.
- 5 be observed in your normal workplace on at least **1 occasion** removing and replacing units and components from one of the following systems:
  - a steering
  - b suspension
  - c braking.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings when working on heavy vehicle chassis systems and components			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle chassis unit and component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy vehicle chassis unit and component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle chassis 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 remove and replace heavy vehicle chassis systems			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
4 Be able to carry out removal and replacement of heavy vehicle chassis units and components	4.1 remove and replace the heavy vehicle's chassis systems and components, adhering to the correct specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements  4.2 ensure that replaced heavy vehicle chassis units and components conform to the vehicle operating specification and any legal requirements  4.3 use suitable testing methods to evaluate the performance of the reassembled system  4.4 ensure that the reassembled heavy vehicle chassis system performs to the vehicle operating specification and meets any legal requirements  4.5 compete all system diagnostic activities within the agreed timescales			
5 Be able to record information and make suitable recommendations	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		5.3	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional auto electrical faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 26: Competency Required to Inspect Heavy Vehicles Using Prescribed Methods

Unit reference number: D/601/4906

QCF level: 2

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit allows the learner to demonstrate competency in order to carry out a range of inspections on heavy vehicles using a variety of prescribed testing and inspection methods.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of carrying out **at least 2** different inspections from the following:
  - a pre-delivery and pre-purchase
  - b daily vehicle checks
  - c pre and post rental inspections
  - d pre and post work inspection
- 5 be observed by your assessor in your normal workplace carrying out an inspection on at least 1 occasion.

Evidence from simulated activities is **not** acceptable for this unit.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle inspections using prescribed methods	1.1	use suitable personal protective equipment and vehicle coverings when carrying out heavy vehicle inspections using prescribed methods			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	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			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for carrying out a range of inspections on heavy vehicle systems including: a pre-delivery and pre-purchase b daily vehicle checks c pre and post rental inspections			
		3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		3.3	use the tools and equipment in the way specified by manufacturers when carrying out a range of inspections on heavy vehicle systems			
4	Be able to carry out heavy vehicle inspections using prescribed methods	4.1	<p>carry out heavy vehicle inspections using prescribed methods, adhering to the specifications and tolerances for the vehicle and following:</p> <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 prescribed documentation</li> </ul>			
		4.2	ensure that the inspected heavy vehicle conforms to the vehicle operating specification and any legal requirements			
		4.3	<p>ensure any comparison of the vehicle against specification accurately identifies any:</p> <ul style="list-style-type: none"> <li>a differences from the vehicle specification</li> <li>b vehicle appearance and condition faults</li> </ul>			
		4.4	use suitable testing methods to evaluate the performance of the inspected systems			
		4.5	complete all system diagnostic activities within the agreed timescales			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_

(if sampled)

## Unit 27: Competency in Removing and Replacing Heavy Vehicle Transmission and Driveline Units and Components

Unit reference number: M/601/4926

QCF level: 2

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in removing and replacing heavy vehicle transmission and driveline units. It also covers the evaluation of performance of the replaced units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of removing and replacing **3 different units or components** in total which **must include items from** the list below:
  - a clutch
  - b gearbox
  - c drive line (shafts, couplings, hubs and bearings)
  - d final drive
- 5 be observed by your assessor in your normal workplace on at least 1 occasion.

Simulated activity **will be** acceptable to assess candidates' competence in removal and replacement on no more than **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle transmission and driveline system component removal and replacement activities	1.1	use suitable personal protective equipment and vehicle coverings throughout when working on heavy vehicle transmission and driveline systems			
		1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy component removal and replacement activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b removal and replacement procedures</li> <li>c legal requirements</li> </ul>			
		2.2	use technical information to support heavy component removal and replacement activities			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for removal and replacement of heavy vehicle transmission and driveline systems			
		3.2	ensure that the equipment has been calibrated to meet manufacturers' and legal requirements			
		3.3	use the tools and equipment in the way specified by manufacturers to remove and replace heavy vehicle transmission and driveline systems,			

Learning outcomes	Assessment criteria		Evidence type	Portfolio reference	Date
4 Be able to carry out removal and replacement of heavy vehicle transmission and driveline units and components.	4.1	remove and replace the heavy vehicle's transmission and driveline systems and components, adhering to the specifications and tolerances for the vehicle and following: a the manufacturer's approved removal and replacement methods b recognised researched repair methods c health and safety requirements			
	4.2	ensure that replaced heavy vehicle transmission and driveline units and components conform to the vehicle operating specification and any legal requirements			
	4.3	use suitable testing methods to evaluate the performance of the reassembled system			
	4.4	ensure that the reassembled heavy vehicle transmission and driveline system performs to the vehicle operating specification and meets any legal requirements			
	4.5	complete all system diagnostic activities within the agreed timescale			
5 Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
	5.4	record and report any additional faults noticed during the course of their work promptly in the format required				

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## Unit 28: Knowledge of Diagnosis and Rectification of Vehicle Auxiliary Electrical Faults

Unit reference number: A/601/3746

QCF level: 3

Credit value: 6

Guided learning hours: 45

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### Unit Summary

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.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### 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 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 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 In Car Entertainment (ICE) 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 ICE 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 ICE systems**

- a operation of entertainment systems speaker and aerial systems

### **Common faults and testing methods associated with ICE 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 LED's
  - 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 LED's
  - vii wiring
  - viii connections and protection devices
  - ix removal and refitting procedures
  - x using computer diagnostics to identify faults
  - xi use of manufacturers 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

## **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 are:**

- 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 measurements)
- g condition
- h 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand vehicle electrical and electronic principles	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:			
2	Understand how light vehicle auxiliary electrical systems operate	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand how to diagnose and rectify faults in auxiliary electrical systems	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
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## Unit 29: Skills in Diagnosing and Rectifying Vehicle Auxiliary Electrical Faults

Unit reference number: H/601/3868

QCF level: 3

Credit value: 5

Guided learning hours: 45

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### Unit Summary

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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 be observed by an assessor carrying out diagnosis and rectification activities from **3 different systems out of the 14 listed below**, which covers the learning outcomes. The fault should involve a **2 or more** step diagnostic activity.
  - a lighting systems
  - b heated seats
  - c electrically adjusted seats
  - d heated screens
  - e electric mirrors
  - f electric sunroofs
  - g electric windows
  - h heating and ventilation systems
  - i information and entertainment systems
  - j communication systems
  - k SRS
  - l wash wipe
  - m locking systems
  - n security and warning systems

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out automotive vehicle auxiliary electrical diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support automotive 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 automotive auxiliary electrical system faults			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out automotive vehicle auxiliary electrical diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c health and safety requirements			
		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			
5	Be able to record information and make suitable recommendations	5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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			

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Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

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## Unit 30: Skills Required to Inspect Heavy Vehicles to Comply With Legal Requirements

Unit reference number: R/601/4983

QCF level: 3

Credit value: 2

Guided learning hours: 20

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### Unit Summary

This unit allows the learner to demonstrate they can carry out a range of heavy vehicle legal compliance inspections using a variety of methods.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your normal workplace or in a Realistic Work Environment as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 be observed by your assessor carrying out **at least 2** different inspection from the following:
  - a pre-MOT inspection
  - b scheduled safety inspections (PMI)
  - c post accident safety inspection

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle inspections	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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle inspection activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b inspection procedures</li> <li>c legal requirements</li> <li>d heavy vehicle inspection manual</li> </ul>			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	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 (PMI)</li> <li>b scheduled safety inspections</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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle inspections	4.1	<p>carry out heavy vehicle inspections, adhering to the specifications and tolerances for the vehicle and following:</p> <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			
		5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required			
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
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## **Unit 31: Knowledge of Diagnosis and Rectification of Heavy Vehicle Engine Faults**

**Unit reference number:** Y/601/4953

**QCF level:** 3

**Credit value:** 6

**Guided learning hours:** 45

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### **Unit Summary**

This unit enables the learner to develop knowledge of diagnosis and rectification of engine mechanical, electrical, hydraulic and fluid systems.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

- a the construction and operation of engine systems
  - i electronic diesel control systems (EDC)
  - ii common rail fuel systems
  - iii unit injection fuel systems
  - iv engine management
  - v pressure charged induction systems
  - vi exhaust emission reduction systems
  - vii mechanical fuel injection systems
  - viii valve mechanisms
  - ix 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 compression ignition 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 systems
  - 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 & 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how heavy vehicle engine systems operate	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			
2	Understand how to diagnose and rectify faults in heavy vehicle engine systems	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
	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				

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Unit 32: Skills Diagnosing and Rectifying Heavy Vehicle Engine Faults

Unit reference number: Y/601/4984

QCF level: 3

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order to diagnose and rectify heavy vehicle engine mechanical, electrical, hydraulic and fluid systems faults.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of carrying out the diagnosis and rectification of faults occurring in **3 out of the 7** engine systems listed. The faults should involve a **2 or more** step diagnostic activity.
  - a engine mechanical components
  - b cooling
  - c fuel systems
  - d engine management system
  - e pressure charged induction systems
  - f exhaust emission reduction systems
  - g lubrication

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle engine diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle engine diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			
5	Be able to record information and make suitable recommendations	5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 33: Knowledge of Diagnosis and Rectification of Heavy Vehicle Chassis Faults

Unit reference number: K/601/4956

QCF level: 3

Credit value: 6

Guided learning hours: 45

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### Unit Summary

This unit enables the learner to develop knowledge of diagnosis and rectification of braking steering and suspension systems. It also covers heavy vehicle chassis systems and the evaluation of their performance.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### 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
  - i voltages
  - ii current consumption
  - iii resistance
  - iv output patterns with oscilloscope
  - v pressures
  - vi condition
  - vii 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
  - iv hoses
  - v 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 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
  - vi 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
  - 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
- 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 and incorrect settings
- j rectification or replacement procedures
- k operation of systems following diagnosis and repair to confirm operation and performance

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how the heavy vehicle chassis systems operate	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 <ul style="list-style-type: none"> <li>a inertia force, mass and acceleration</li> <li>b laws of friction</li> <li>c static's (springs and torsion bars)</li> <li>d hydraulic machines</li> </ul>			
2	Understand how to diagnose and rectify faults in heavy vehicle chassis systems	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			

Learning outcomes		Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## Unit 34: Skills in Diagnosing and Rectifying Heavy Vehicle Chassis System Faults

Unit reference number: D/601/4985

QCF level: 3

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order to 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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of carrying out the diagnosis and rectification of **2** faults occurring in the systems listed below. The faults should involve a **2 or more** step diagnostic activity. The evidence must include demonstration of skill in at least **1** of each: mechanical and electrical / electronic or hydraulic / pneumatic units or components
  - a steering systems
  - b suspension systems
  - c braking systems

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle chassis diagnostic and rectification activities	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 vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	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 chassis system faults			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle chassis diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 35: Competency Required to Inspect Heavy Vehicles to Comply with Legal Requirements

Unit reference number: H/601/4910

QCF level: 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit allows the learner to demonstrate competency in order to carry out a range of heavy vehicle legal compliance inspections using a variety of methods.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of carrying out **at least 2** different inspections on **2 occasions each** from the following:
  - a pre-MOT inspection
  - b scheduled safety inspections (PMI)
  - c post accident safety inspection
- 5 be observed by your assessor **in your normal workplace** carrying out an inspection on **at least 1 occasion**.

Evidence from simulated activities is not acceptable for this unit.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle inspections	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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support heavy vehicle inspection activities including: <ul style="list-style-type: none"> <li>a vehicle technical data</li> <li>b inspection procedures</li> <li>c legal requirements</li> <li>d heavy vehicle inspection manual</li> </ul>			
		2.2	use technical information to support heavy vehicle inspection activities			
3	Be able to use appropriate tools and equipment	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 (PMI)</li> <li>b scheduled safety inspections</li> </ul>			
		3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		3.3	use the tools and equipment in the way specified by manufacturers when carrying out a range of inspections on heavy vehicle systems			
4	Be able to carry out heavy vehicle inspections	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			
		4.4	complete all system diagnostic activities within the agreed timescale			
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## Unit 36: Competency in Diagnosing and Rectifying Heavy Vehicle Engine Faults

Unit reference number: M/601/4912

QCF level: 3

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in diagnosing and rectifying heavy vehicle engine mechanical, electrical, hydraulic and fluid systems faults.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of diagnosing and rectifying faults occurring in **4 out of the 7\*** engine systems listed, **at least 3** of which must come from work carried out **in your normal workplace**.
- 5 use a **2 or more** step diagnostic activity
  - a engine mechanical components
  - b cooling
  - c fuel systems
  - d engine management system
  - e pressure charged induction systems
  - f exhaust emission reduction systems
  - g lubrication

6 be observed by your assessor on at least 2 occasions, each observation covering the diagnosis and rectification of a fault in different systems. Both of these observations must be carried out in your normal workplace.

- \* However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of faults occurring in all the types of engine systems.

Simulated activity will be acceptable to assess candidates' competence in diagnosis and rectification on no more than 1 occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle engine diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle engine diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			
		4.8	complete all system diagnostic activities within the agreed timescale			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)



## Unit 37: Competency in Diagnosing and Rectifying Heavy Vehicle Chassis System Faults

Unit reference number: A/601/4914

QCF level: 3

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in diagnosing and rectifying heavy vehicle braking steering and suspension systems faults. It also covers the evaluation of performance of the replaced or repaired units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy.
- 4 produce evidence of diagnosing and rectifying **3 faults**. At least **1** fault must be from **each** system listed. The fault should involve a **2 or more** step diagnostic activity. The **range** of evidence must include demonstration of competence in diagnosis and rectification in at least **1 of each**: mechanical, electrical / electronic and hydraulic / pneumatic units or components. **At least 2** pieces of evidence must come from work carried out **in your normal workplace**.
  - a steering systems
  - b suspension systems
  - c braking systems

- 5 be observed by your assessor on at least 1 occasion in your normal workplace, covering the diagnosis and rectification of a fault.

Simulated activity **will be** acceptable to assess candidates' competence in diagnosis and rectification on no more than **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle chassis diagnostic and rectification activities	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 vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	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 chassis system faults			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle chassis diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			
		4.8	complete all system diagnostic activities within the agreed timescales			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Unit 38: Knowledge of How to Make Learning Possible through Demonstrations and Instruction

Unit reference number: T/601/6242

QCF level: 3

Credit value: 5

Guided learning hours: 45

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### Unit Summary

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.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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 practice 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 learners 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 learners 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 effect 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 effect 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	understand the nature and role of demonstrations and instruction	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			
2	understand the principles and concepts of demonstration and instruction	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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			
3	understand the external factors influencing human resource development	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_

(if sampled)

## Unit 39: Skills in How to Make Learning Possible through Demonstrations and Instruction

Unit reference number: Y/601/6282

QCF level: 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit will help the learner to develop the skills required 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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 provide **1 record** of an activity which has been a combination of demonstration and instruction
- 5 provide records of an **observation**, which covers **a combination of demonstration and instruction**

It is expected that the **records** must include evidence to show how you:

- a decided on the sequence of the demonstration
- b ensured that the demonstration was accurate and realistic
- c identified which learning outcomes were achieved
- d ensured a safe environment for the demonstration and allowed all learners to see the demonstration clearly

In preparing the record you should consider:

- a which types of learning are best achieved and supported through demonstrations
- b how to choose between instruction and demonstration as learning methods
- c how to identify individual learning needs
- d which factors are likely to prevent learning and how to overcome them
- e how to choose and prepare appropriate materials, including technology based materials.
- f which types of learning are best achieved through instruction
- g how to make sure everybody acts in line with health, safety and environmental protection legislation and best practice
- h how to analyse developments in learning and new ways of delivery, including technology based learning

It is also expected that evidence from your observations **will show** how you:

- a structured the demonstration so that the learner got the most out of it
- b encouraged learners to ask questions and get explanations at appropriate stages in the demonstration
- c gave learners the opportunities to practice the skill being demonstrated
- d gave learners positive feedback
- e reinforced learning by repeating demonstration
- f responded to the needs of learners during the demonstration
- g reduced distractions and disruptions as much as possible
- h matched instruction to the needs of learners
- i ensured that the manner, level and speed of the instruction encourages learners to take part
- j regularly check that learners understand and adapt instruction as appropriate
- k gave learners positive feedback on the learning experience and the outcome achieved
- l identified anything that prevented learning and reviewed this with the learner

Evidence from **real** or **simulated** activities and **role play** is acceptable for this unit.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to demonstrate skills and methods to learners	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 outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
2	Be able to instruct learners	2.1	implement instruction which is matched to the needs of learners			
		2.2	use identified learning outcomes which can be achieved through instruction			
		2.3	perform instruction, ensuring that the manner, level and speed of the instruction encourages learners to take part			
		2.4	perform instruction whilst regularly checking that the learners understand and adapt instruction as appropriate			
		2.5	give learners positive feedback on the learning experience and the outcomes achieved			
		2.6	carry out a review with the learners to identify anything that prevented learning and adapt instruction as appropriate			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 40: Competency in Making Learning Possible through Demonstrations and Instruction

Unit reference number: Y/601/6380

QCF level: 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit will help the learner to develop competency 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.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy **or** by a witness who has been previously agreed with the assessor prior to the observation taking place.
- 4 provide at least **1 record** of an activity which has been demonstrated.
- 5 provide records of at least **2 observations, 1** of which **must be** by your assessor, which cover at least **1 demonstration and 1 instruction or a combination of both.**

- a it is expected that the **records** must include evidence to show how you:
  - i decided on the sequence of the demonstration
  - ii ensured that the demonstration was accurate and realistic
  - iii identified which learning outcomes were achieved
  - iv ensured a safe environment for the demonstration and allowed all learners to see the demonstration clearly
  
- b in preparing the records you should consider:
  - i which types of learning are best achieved and supported through demonstrations
  - ii how to choose between instruction and demonstration as learning methods
  - iii how to identify individual learning needs
  - iv which factors are likely to prevent learning and how to overcome them
  - v how to choose and prepare appropriate materials, including technology based materials
  - vi which types of learning are best achieved through instruction
  - vii how to make sure everybody acts in line with health, safety and environmental protection legislation and best practice
  - viii how to analyse developments in learning and new ways of delivery, including technology based learning
  
- c it is also expected that evidence from your observations **will show** how you:
  - i structured the demonstration so that the learner got the most out of it
  - ii encouraged learners to ask questions and get explanations at appropriate stages in the demonstration
  - iii gave learners the opportunities to practice the skill being demonstrated
  - iv gave learners positive feedback
  - v reinforced learning by repeating demonstration
  - vi responded to the needs of learners during the demonstration
  - vii reduced distractions and disruptions as much as possible
  - viii matched instruction to the needs of learners
  - ix ensured that the manner, level and speed of the instruction encourages learners to take part
  - x regularly check that learners understand and adapt instruction as appropriate
  - xi gave learners positive feedback on the learning experience and the outcome achieved
  - xii identified anything that prevented learning and reviewed this with the learner

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to demonstrate skills and methods to learners	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			
2	Be able to instruct learners	2.1	implement instruction which is matched to the needs of learners			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
	2.2	use identified learning outcomes which can be achieved through instruction				
	2.3	perform instruction, ensuring that the manner, level and speed of the instruction encourages learners to take part				
	2.4	perform instruction whilst regularly checking that the learners understand and adapt instruction as appropriate				
	2.5	give learners positive feedback on the learning experience and the outcomes achieved				
	2.6	carry out a review with the learners to identify anything that prevented learning and adapt instruction as appropriate				

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## **Unit 41: Knowledge of how to Identify and Agree Motor Vehicle Customer Service Needs**

**Unit reference number:** R/601/6247

**QCF level:** 3

**Credit value:** 5

**Guided learning hours:** 45

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### **Unit Summary**

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.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand legislative and organisational requirements and procedures	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			
2	Understand how to communicate and care for customers	2.1	explain how to communicate effectively with customers			
		2.2	describe how to adapt your 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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand company products and services	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Unit 42: Skills to Identify and Agree Motor Vehicle Customer Service Needs

Unit reference number: M/601/6286

QCF level: 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit helps the learner to develop 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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the
- 4 produce evidence, including records, to show that you have dealt with **3 different customers**
- 5 be observed by your assessor on at least **1** occasion

Evidence from real activity **or role-play is acceptable** for this unit

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to obtain relevant information from the customer	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			
2	Be able to provide relevant information to the customer	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			
3	Be able to agree work undertaken with the customer	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			
4	Be able to ensure recording systems are implemented correctly	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			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_



## **Unit 43: Knowledge of Overhauling Heavy Vehicle Engine Mechanical Units**

**Unit reference number:** M/601/4957

**QCF level:** 3

**Credit value:** 5

**Guided learning hours:** 42

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### **Unit Summary**

This unit enables the learner to develop knowledge of the construction and operation and overhaul of engines units.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to overhaul heavy vehicle engine units	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 manufacturers specifications and settings			
		1.9	explain how to evaluate the operation of components and systems following overhauling units to confirm system performance			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 44: Skills Required to Overhaul Heavy Vehicle Engine Mechanical Units

Unit reference number: T/601/4989

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit allows the learner to demonstrate skills in order to overhaul engines. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre.
- 3 be observed by an assessor as defined by the IMI Assessment Strategy.
- 4 produce evidence of overhauling **1 unit** which includes cylinder head and block.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle engine mechanical units	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out the overhauling of heavy vehicle engine mechanical units	4.1	<p>carry out all overhauling of heavy vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following:</p> <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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## **Unit 45: Knowledge of Overhauling Heavy Vehicle Transmission Units**

**Unit reference number:** A/601/4959

**QCF level:** 3

**Credit value:** 4

**Guided learning hours:** 40

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### **Unit Summary**

This unit enables the learner to develop knowledge of the construction and operation and overhaul of gearboxes and final drive assemblies.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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 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-statement 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-statement of components and fittings
  - v cancelling of any fault codes and warning lights

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to overhaul heavy vehicle gearbox and final drive units	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 manufacturers specifications and settings			
		1.9	explain how to evaluate the operation of components and systems following overhauling units to confirm system performance			

Learner name: \_\_\_\_\_  
Learner signature: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_  
(if sampled)

Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 46: Competency in Identifying and Agreeing Motor Vehicle Customer Service Needs

Unit reference number: K/601/6383

QCF level: 3

Credit value: 5

Guided learning hours: 40

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### Unit Summary

This unit helps the learner to develop competency in order 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.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence, including records, to show that you have dealt with **3 different customers**
- 5 be observed by your assessor in your normal workplace dealing with **at least 1 customer**.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to obtain relevant information from the customer	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			
2	Be able to provide relevant information to the customer	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			
3	Be able to agree work undertaken with the customer	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			
4	Be able to ensure recording systems are implemented correctly	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)



## Unit 47: Competency in Overhauling Heavy Vehicle Engine Mechanical Units

Unit reference number: L/601/4917

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit will enable the learner to demonstrate competency in overhauling engines. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of **overhauling 2 complete engine units** to include cylinder head and block
- 5 overhaul **1** of the above units **in your normal workplace**
- 6 be observed by your assessor overhauling **1 unit**

Simulated activity **will be** acceptable to assess candidates' competence in overhauling units on no more than **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle engine mechanical units	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out the overhauling of heavy vehicle engine mechanical units	4.1	<p>carry out all overhauling of heavy vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following:</p> <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			
		4.7	complete all system diagnostic activities within the agreed timescales			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 48: Skills Required to Overhaul Heavy Vehicle Transmission Units

Unit reference number: K/601/4990

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit allows the learner to demonstrate skills in order to overhaul gearboxes and final drive assemblies. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of overhauling **1 unit** which includes **either** a Gearbox **or** a Final Drive unit.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle Transmission units	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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support the overhauling of heavy vehicle transmission 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 transmission units			
3	Be able to use appropriate tools and equipment	3.1	select the appropriate tools and equipment necessary for 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 unit			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out the overhauling of heavy vehicle transmission units	4.1	<p>carry out all overhauling of heavy vehicle transmission units, adhering to the specifications and tolerances for the vehicle and following:</p> <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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## **Unit 49: Knowledge of Overhauling Heavy Vehicle Steering and Suspension Units**

**Unit reference number:** T/601/4961

**QCF level:** 3

**Credit value:** 4

**Guided learning hours:** 40

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### **Unit Summary**

This unit enables the learner to develop knowledge of the construction and operation and overhaul of steering and suspension units.

### **Assessment Requirements/Evidence requirements:**

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

#### **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:
  - iii PPE
  - iv vehicle protection when dismantling
  - v 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-statement 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-statement of components and fittings
  - v cancelling of any fault codes and warning lights

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how to overhaul heavy vehicle steering and suspension units	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 manufacturers specifications and settings			
		1.9	explain how to evaluate the operation of components and systems following overhauling units to confirm system performance			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 50: Skills Required to Overhaul Heavy Vehicle Steering and Suspension Units

Unit reference number: A/601/4993

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit allows the learner to demonstrate skills in order to overhaul steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of overhauling **2 units** which includes **1** steering unit and **1** suspension unit.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle Steering and suspension units	1.1	use suitable personal protective equipment and vehicle coverings when overhauling heavy vehicle steering and suspension units work in a way which minimises the risk of damage or injury to the vehicle, people and the environment			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support the overhauling of heavy vehicle steering and suspension 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 steering and suspension units			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes	Assessment criteria		Evidence type	Portfolio reference	Date
4 Be able to carry out the overhauling of heavy vehicle steering and suspension units	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				

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*

## Unit 51: Knowledge of Diagnosis and Rectification of Heavy Transmission and Driveline Faults

Unit reference number: L/601/4965

QCF level: 3

Credit value: 6

Guided learning hours: 40

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### Unit Summary

This unit enables the learner to develop knowledge 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.

### Assessment Requirements/Evidence requirements:

If this unit is offered within a competence qualification (VCQ) it must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*).

This unit must adhere to the IMI Knowledge Unit Syllabus as set out below:

### **The construction and operation of transmission and driveline systems. Including:**

- 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 & shafts

### **Key principles relating to heavy vehicle transmission and driveline systems**

- a friction
- b torque transmission
- c materials
- d fluids & energy
- e potential & 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 & 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 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 abnormal noises
  - vi vibrations
  - vii loss of drive
  - viii failure to engage gear
  - ix failure to disengage gear
  - x leaks
  - xi failure to operate
  - xii incorrect shift patterns
  - xiii 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 & 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

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand how the heavy vehicle transmission and driveline systems operate	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 & energy e potential & kinetic energy			
2	Understand how to diagnose and rectify faults in heavy vehicle transmission and driveline systems	2.1	explain the symptoms and causes of faults found in heavy vehicle transmission and driveline systems			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		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 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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 52: Skills in Diagnosis and Rectify Heavy Vehicle Transmission and Driveline Faults

Unit reference number: R/601/4997

QCF level: 3

Credit value: 5

Guided learning hours: 45

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### Unit Summary

This unit allows the learner to demonstrate skills in order 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.

### Assessment Requirements/Evidence requirements:

This unit must adhere to the IMI Skills Unit Assessment Requirements developed for the unit as set out below:

#### You must:

- 1 produce evidence to show you meet **all** of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out in your training workshop as managed and organised by an approved centre
- 3 be observed by an assessor as defined by the IMI Assessment Strategy
- 4 produce evidence of carrying out the diagnosis and rectification of faults occurring in **2** of the systems listed. The fault should involve a **2 or more** step diagnostic activity
  - a clutch
  - b gearbox
  - c drive line (shafts, couplings, hubs and bearings)
  - d final drive

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle transmission and driveline diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle transmission and driveline diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 53: Competency in Overhauling Heavy Vehicle Transmission Units

Unit reference number: L/601/4917

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit will enable the learner to demonstrate competency in overhauling gearboxes and final drive assemblies. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of overhauling **1 Gearbox and 1 Final Drive unit**
- 5 overhaul **1** of the above units **in your normal workplace**
- 6 be observed by your assessor overhauling **1 unit**.

Simulated activity **will be** acceptable to assess candidates' competence in overhauling units on no more than **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle engine mechanical units	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out the overhauling of heavy vehicle engine mechanical units	4.1	<p>carry out all overhauling of heavy vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following:</p> <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			
		4.7	complete all system diagnostic activities within the agreed timescales			
5	Be able to record information and make suitable recommendations	5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
		5.2	make suitable and justifiable recommendations for cost effective repairs			
		5.3	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 54: Competency in Overhauling Heavy Vehicle Steering and Suspension Units

Unit reference number: H/601/4924

QCF level: 3

Credit value: 6

Guided learning hours: 50

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### Unit Summary

This unit will enable the learner to demonstrate competency in overhauling steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of overhauling **1 steering and 1 suspension unit**
- 5 overhaul **1** of the above units **in your normal workplace**
- 6 be observed by your assessor **overhauling at least 1 unit, which must be in your normal workplace.**

Simulated activity will be acceptable to assess candidates' competence in overhauling units on no more than 1 occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria	Evidence type	Portfolio reference	Date
1	Be able to work safely when overhauling heavy vehicle Steering and suspension units	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		
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support the overhauling of heavy vehicle steering and suspension 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 steering and suspension units		
3	Be able to use appropriate tools and equipment	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		

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
4 Be able to carry out the overhauling of heavy vehicle steering and suspension units	<p>4.1 carry out all overhauling of heavy vehicle steering and suspension units, adhering to the specifications and tolerances for the vehicle and following:</p> <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> <p>4.2 ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul</p> <p>4.3 inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform</p> <p>4.4 use testing methods that comply with the manufacturer's requirements</p> <p>4.5 adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements</p> <p>4.6 ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements</p> <p>4.7 complete all system diagnostic activities within the agreed timescales</p>			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_

Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_

Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_

Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(if sampled)

## Unit 55: Competency in Diagnosing and Rectifying Heavy Vehicle Transmission and Driveline Faults

Unit reference number: F/601/4929

QCF level: 3

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in diagnosing and rectifying 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.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of diagnosing and rectifying at least 3 transmission and driveline faults. The faults must be from 2 of the 4\* systems listed below. The fault should involve a 2 or more step diagnostic activity. At least 2 pieces of evidence must come from work carried out in your normal workplace.
  - i clutch
  - ii gearbox
  - iii drive line (shafts, couplings, hubs and bearings)
  - iv final drive

5 be observed by your assessor on at least 1 occasion in your normal workplace carrying out the diagnosis and rectification of a fault in a transmission or drive line system.

- \* However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of faults occurring in all the types of engine systems.

Simulated activity will be acceptable to assess candidates' competence in diagnosis and rectification on no more than 1 occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out heavy vehicle transmission and driveline diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	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			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria			Evidence type	Portfolio reference	Date
4	Be able to carry out heavy vehicle transmission and driveline diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements				
		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				
		4.8	complete all system diagnostic activities within the agreed timescale				

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Unit 56: Competency in Diagnosing and Rectifying Vehicle Auxiliary Electrical Faults

Unit reference number: L/601/3749

QCF level: 3

Credit value: 10

Guided learning hours: 90

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### Unit Summary

This unit will enable the learner to demonstrate competency in diagnosing and rectifying automotive vehicle auxiliary electrical system faults. It also covers the evaluation of performance of the replaced or repaired units and systems.

### Assessment Requirements/Evidence requirements:

This unit must be assessed in accordance with the IMI Assessment Strategy (*Annexe C*) and adhere to the IMI Competency Unit Assessment Requirements as detailed below:

#### You must:

- 1 produce evidence to show you meet all of the Learning Outcomes
- 2 produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or as defined within the IMI VCQ Assessment Strategy as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk
- 3 be observed by an assessor as defined in the IMI VCQ Assessment Strategy
- 4 produce evidence of carrying out diagnosis and rectification activities from **4 different systems out of the 16 listed below** \*. One of which must be alternator or a starter motor. The fault should involve a **2 or more** step diagnostic activity. **At least 3** pieces of evidence must come from work carried out **in your normal workplace**.
  - a lighting systems
  - b heated seats
  - c electrically adjusted seats
  - d heated screens
  - e electric mirrors
  - f electric sunroofs
  - g electric windows

- h heating and ventilation systems
- i information and entertainment systems
- j communication systems
- k SRS
- l wash wipe
- m locking systems
- n security and warning systems
- o alternators
- p starter motors

5 be observed by your assessor on **at least 1 occasion**, covering the diagnosis and rectification of a fault.

- \* However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of faults occurring in all the types of electrical systems.

Simulated activity **will be** acceptable to assess candidates' competence in diagnosis and rectification on no more than **1** occasion.

## Learning outcomes and assessment criteria

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Be able to work safely when carrying out automotive vehicle auxiliary electrical diagnostic and rectification activities	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			
2	Be able to use relevant information to carry out the task	2.1	select suitable sources of technical information to support automotive 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 automotive auxiliary electrical system faults			
3	Be able to use appropriate tools and equipment	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			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
4	Be able to carry out automotive vehicle auxiliary electrical diagnosis, rectification and test activities	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: a manufacturers' instructions b recognised researched repair methods c workplace procedures d health and safety requirements			
		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			
		4.8	complete all system diagnostic activities within the agreed timescale			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
5	Be able to record information and make suitable recommendations	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	identify and report any expected delays in completion to the relevant person(s) promptly in the format required			
		5.4	record and report any additional faults noticed during the course of their work promptly in the format required			

Learner name: \_\_\_\_\_ Date: \_\_\_\_\_  
Learner signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Assessor signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Internal verifier signature: \_\_\_\_\_ Date: \_\_\_\_\_  
*(if sampled)*



## Further information

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Our customer service numbers are:

BTEC and NVQ	0844 576 0026
GCSE	0844 576 0027
GCE	0844 576 0025
The Diploma	0844 576 0028
DiDA and other qualifications	0844 576 0031

Calls may be recorded for training purposes.

## Useful publications

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Related information and publications include:

- *Centre Handbook for Edexcel QCF NVQs and Competence-based Qualifications* published annually
- functional skills publications – specifications, tutor support materials and question papers
- *Regulatory Arrangements for the Qualification and Credit Framework* (published by Ofqual, August 2008)
- the current Edexcel publications catalogue and update catalogue.

Edexcel publications concerning the Quality Assurance System and the internal and standards verification of vocationally related programmes can be found on the Edexcel website.

NB: Some of our publications are priced. There is also a charge for postage and packing. Please check the cost when you order.

## How to obtain National Occupational Standards

To obtain the National Occupational Standards go to [www.ukstandards.org.uk](http://www.ukstandards.org.uk).

## Professional development and training

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Edexcel supports UK and international customers with training related to NVQ and BTEC qualifications. This support is available through a choice of training options offered in our published training directory or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing student-centred learning and teaching approaches
- building functional skills into your programme
- building effective and efficient quality assurance systems.

The national programme of training we offer can be viewed on our website ([www.edexcel.com/training](http://www.edexcel.com/training)). You can request customised training through the website or by contacting one of our advisers in the Training from Edexcel team via Customer Services to discuss your training needs.

The training we provide:

- is active
- is designed to be supportive and thought provoking
- builds on best practice
- may be suitable for those seeking evidence for their continuing professional development.

## Annexe A: Progression pathways

### The Edexcel qualification framework for the Automotive sector

Level	BTEC vocationally-related qualifications	BTEC specialist qualification/ professional	NVQ/competence
<b>5</b>	BTEC Level 5 HND Diploma in Vehicle Operations Management (QCF)		
<b>4</b>	BTEC Level 4 HNC Diploma in Vehicle Operations Management (QCF)		
<b>3</b>		<p>Edexcel BTEC Level 3 Diploma in Light Vehicle Maintenance and Repair Principles (QCF)</p> <p>Edexcel BTEC Level 3 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF)</p> <p>Edexcel BTEC Level 3 Diploma in Auto Electrical and Mobile Electrical Principles (QCF)</p> <p>Edexcel BTEC Level 3 Diploma in Vehicle Fitting Supervisory Principles (QCF)</p> <p>Edexcel BTEC Level 3 Diploma in Vehicle Accident Repair Body Principles (QCF)</p> <p>Edexcel BTEC Level 3 Diploma in Vehicle Accident Repair Paint Principles (QCF)</p>	<p>Edexcel Level 3 Diploma in Light Vehicle Maintenance and Repair Competence (QCF)</p> <p>Edexcel Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence(QCF)</p> <p>Edexcel Level 3 Diploma in Auto Electrical and Mobile Electrical Competence (QCF)</p> <p>Edexcel Level 3 Diploma in Vehicle Fitting Supervisory Competence (QCF)</p> <p>Edexcel Level 3 Diploma in Vehicle Accident Repair Body Competence (QCF)</p> <p>Edexcel Level 3 Diploma in Vehicle Accident Repair Paint Competence (QCF)</p>

Level	BTEC vocationally-related qualifications	BTEC specialist qualification/ professional	NVQ/competence
<b>3</b>		Edexcel BTEC Level 3 Diploma in Lift Truck Maintenance & Repair Principles (QCF) Edexcel BTEC Level 3 Diploma in Motorcycle Maintenance and Repair Principles (QCF) Edexcel BTEC Level 3 Diploma in Vehicle Sales Principles (QCF) Edexcel BTEC Level 3 Diploma in Body Building Principles (QCF)	Edexcel Level 3 Diploma in Lift Truck Maintenance & Repair Competence (QCF) Edexcel Level 3 Diploma in Motorcycle Maintenance and Repair Competence (QCF) Edexcel Level 3 Diploma in Vehicle Sales Competence (QCF) Edexcel Level 3 Diploma in Body Building Competence (QCF)
<b>2</b>		Edexcel BTEC Level 2 Diploma in Light Vehicle Maintenance and Repair Principles (QCF) Edexcel BTEC Level 2 Diploma in Heavy Vehicle Maintenance and Repair Principles (QCF) Edexcel BTEC Level 2 Diploma in Auto Electrical and Mobile Electrical Principles (QCF) Edexcel BTEC Level 2 Diploma in Vehicle Fitting Principles (QCF) Edexcel BTEC Level 2 Diploma in Vehicle Accident Repair Principles (QCF) Edexcel BTEC Level 2 Diploma in Vehicle Accident Repair Body Principles (QCF)	Edexcel Level 2 Diploma in Light Vehicle Maintenance and Repair Competence(QCF) Edexcel Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence (QCF) Edexcel Level 2 Diploma in Auto Electrical and Mobile Electrical Competence (QCF) Edexcel Level 2 Diploma in Vehicle Fitting Competence (QCF) Edexcel Level 2 Diploma in Vehicle Accident Repair Paint Competence (QCF) Edexcel Level 2 Diploma in Vehicle Accident Repair Body Competence (QCF)

Level	BTEC vocationally-related qualifications	BTEC specialist qualification/ professional	NVQ/competence
<b>2</b>		<p>Edexcel BTEC Level 2 Diploma in Lift Truck Maintenance &amp; Repair Principles (QCF)</p> <p>Edexcel BTEC Level 2 Diploma in Motorcycle Maintenance and Repair Principles (QCF)</p> <p>Edexcel BTEC Level 2 Diploma in Vehicle Sales Principles (QCF)</p> <p>Edexcel BTEC Level 2 Diploma in Vehicle Accident Repair Mechanical, Electrical and Trim (MET) Principles (QCF)</p> <p>Edexcel BTEC Level 2 Diploma in Body Building Principles (QCF)</p> <p>Edexcel BTEC Level 2 Diploma in Heavy Vehicle Trailer Maintenance &amp; Repair Principles (QCF)</p>	<p>Edexcel Level 2 Diploma in Lift Truck Maintenance &amp; Repair Competence (QCF)</p> <p>Edexcel Level 2 Diploma in Motorcycle Maintenance and Repair Competence (QCF)</p> <p>Edexcel Level 2 Diploma in Vehicle Sales Competence (QCF)</p> <p>Edexcel Level 2 Diploma in Vehicle Accident Repair Mechanical, Electrical and Trim (MET) Competence (QCF)</p> <p>Edexcel Level 2 Diploma in Body Building Competence (QCF)</p> <p>Edexcel Level 2 Diploma in Heavy Vehicle Trailer Maintenance &amp; Repair Competence (QCF)</p>
<b>1</b>			
<b>Entry</b>			



## Annexe B: Centre certification and registration

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Edexcel Standards Verifiers will provide support, advice and guidance to centres to achieve Direct Claims Status (DCS). Edexcel will maintain the integrity of Edexcel QCF NVQs through ensuring that the awarding of these qualifications is secure. Where there are quality issues identified in the delivery of programmes, Edexcel will exercise the right to:

- direct centres to take action
- limit or suspend certification
- suspend registration.

The approach of Edexcel in such circumstances is to work with the centre to overcome the problems identified. If additional training is required, Edexcel will aim to secure the appropriate expertise to provide this.

### **What are the access arrangements and special considerations for the qualifications in this specification?**

Centres are required to recruit learners to Edexcel qualifications with integrity.

Appropriate steps should be taken to assess each applicant's potential and a professional judgement should be made about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should consult Edexcel's policy on learners with particular requirements.

Edexcel's policy on access arrangements and special considerations for Edexcel qualifications aims to enhance access to the qualifications for learners with disabilities and other difficulties (as defined by the Equality Act 2010) without compromising the assessment of skills, knowledge, understanding or competence. Please refer to *Access Arrangements and Special Considerations for BTEC and Edexcel NVQ Qualifications* for further details. [www.edexcel.com](http://www.edexcel.com).

Please refer to Edexcel's Equality Policy for further details, [www.edexcel.co/policies/pages/home.aspx](http://www.edexcel.co/policies/pages/home.aspx)





THE INSTITUTE OF THE MOTOR INDUSTRY

# Assessment Strategy

For

# **Vocational Competency Qualifications (VCQs)**

## **Introduction**

This document sets out the recommendations of IMI for the assessment of VCQ qualifications based on IMI developed National Occupational Standards. The Strategy is designed to operate across all four nations, bringing parity to all learners. Awarding Organisations wishing to operate VCQs in the retail motor sector must take full part in the IMI Awarding Body Forum.

This is the overarching strategy for the assessment and verification of competency based qualifications (VCQs) that are based upon National Occupational Standards from the IMI and will come into force on the 30<sup>th</sup> June 2010, it will apply to any new competence -based units and qualifications.

## **Assessment**

VCQs are a type of qualification which reflect the unique needs of the workplace. They should be assessed in a holistic way by technically competent assessors. The primary method of assessment should always be direct workplace observation. Some use of simulation is allowed (please see section, Workplace Assessment/Simulation).

Additionally Awarding Organisations are encouraged to make use of naturally occurring quality assurance and monitoring systems where they exist in workplace assessment environments.

The Institute of the Motor Industry require Awarding Organisations delivering VCQs to participate in an Awarding Body Forum. This will, as a minimum, involve an annual meeting to discuss issues of assessment and verification.

VCQ must attest to competence in an occupational role (where competence is defined as the ability to apply knowledge, understanding, practical and thinking skills to be effective in work: these skills will usually include problem-solving, being flexible to meet changing demands and the ability to work with or alongside others).

Any assessment must attest to competence in an occupational role (where competence is defined as the ability to apply knowledge, understanding, practical and thinking skills to be effective in work: these skills will usually include problem-solving, being flexible to meet changing demands and the ability to work with or alongside others)

## **Evidence Requirements for VCQ**

Candidates working towards a VCQ must provide evidence from the workplace that covers a minimum of a 4 month, (16 week), period.

All evidence for VCQs must be assessed by suitably qualified assessors and must adhere to the requirements for the QCF units being assessed.

## Rules of combination

Rules of combination must be that determined by the IMI SSC.

## Evidence other than from direct workplace observation

### Workplace Assessment/Simulation.

IMI credit- based units are work/competency based and therefore candidates are to be assessed under normal workplace conditions. It is recognised however, that there are situations where the workplace may not be appropriate or that waiting for naturally occurring evidence is impractical. In these situations IMI will allow centres to set up or devise assessment situations.

These assessment situations can only be set up after:-

- all possible routes for the collection of naturally occurring evidence have been exhausted
- the exact make up and content of the centre devised assessment has been agreed and approved by the external verifier
- the assessor can assure that the simulation will provide evidence that is valid reliable and authentic.

We suggest that centres seek written confirmation before proceeding with assessment. The need for simulation may result from consideration of:

- Safety
- Legislation
- Regulation
- Contingency
- Cost
- Frequency.

In addition, IMI recognises that candidates using these credit- based units in the context of a Level 1 qualification may be in a learning environment and not in a workplace. In these situations, centres may set up or devise assessment situations as required, with prior written agreement of the external verifier.

Any simulation must be carried out using actual vehicles; the use of engine rigs or electrical boards is not permitted.

IMI re-iterates that its credit- based units have been designed to be capable of assessment in the normal workplace and that subject to the arrangements for simulation described above this should be the case.

Simulation will be monitored by the Awarding Organisations and where it is found to be the "norm" rather than the exception suitable action will need to be taken.

## **Realistic Work Environment**

The IMI requires that candidates are assessed within their normal workplace, or in exceptional circumstances as described previously via simulation. The use of approved simulation means therefore that RWE, Realistic Work Environment is not to be used.

## **Expert Witnesses**

The use of witness testimony and expert witness testimony are appropriate methods for assessors to collect supplementary evidence on candidates' performance.

Witness testimonies can be obtained from people that are occupationally competent and who may be familiar with the national occupational standards, such as the candidate's line manager.

The assessor must judge the validity of the witness testimony and these may vary depending on the source. Witness testimonies can only support the assessment process and may remove or reduce the need to collect supplementary evidence, however, the awarding organisation's / body's quality assurance requirements must be met. Additionally the person or persons providing the witness testimony evidence must make themselves available to the external verifier for confirmation of evidence validity if required.

## **Remote Observation.**

The use of direct observation from a remote location is permitted as long as the centre seeks and receives the approval of their awarding organisation prior to its use and the awarding organisation discusses and agree this with the IMI prior to its use.

## **Assessor Requirements.**

The assessment of VCQs must be carried out by approved industry competent assessors.

Assessors will be responsible for, and accountable for, the validity, reliability and authenticity of evidence.

The primary responsibility of the assessor is to ensure that candidates satisfy the requirements of the national occupational standards. It is important that an assessor can recognise occupational competence as specified by the national occupational standards. Assessors therefore need to have a thorough understanding of assessment and quality assurance practices, as well as have in depth technical competence related to the qualifications for which they are assessing candidates.

It will be the responsibility of the approved centre to select and appoint assessors.

It will be the responsibility of the Awarding Organisation to approve centre selected assessors.

To be an approved assessor the person must:-

- have sufficient and relevant technical/occupational competence in the Unit, at or above the level of the unit being assessed
- have in-depth knowledge of the qualification or credit- based unit evidence requirements.
- hold or be working towards a relevant assessors award as specified by the Institute of the Motor Industry. This will include, but not be limited to the Assessor qualifications, Level 3 Award in Assessing Competence in the Work Environment, Level 3 Award in Assessing Vocationally Related Achievement, Level 3 Certificate in Assessing Vocational Achievement. (and by implication legacy Assessor units A1, A2 and D32/33 unit) but may be an appropriate equivalent as defined by the IMI, SSC).
- assessors working towards a relevant assessor qualification must achieve their qualification within 12 months.
- demonstrate knowledge and understanding of the competencies that a learner is required to demonstrate for the qualification that they are undertaking
- provide evidence of completing 5 days working/job shadowing in industry within their professional area in a 24 month period.
- provide evidence of 30 hours of technical/qualification related CPD within a 12 month period.(This is in additional to working/job shadowing).
- be approved by the Awarding Organisation to carry out assessments for the VCQs they are competent in.

Approval of assessors can be **removed**.

Assessors **cannot** assess the VCQ if they are not currently approved by, or have had their approval removed by, the Awarding Organisation.

### **Internal Verifier Requirements.**

VCQs must be underpinned by quality assurance appropriate to workplace based delivery. At a minimum this should reflect the principles outlined below.

Internal Verification of VCQ shall be the responsibility of approved industry competent internal verifiers.

The primary responsibility of the internal verifier is to assure the quality and consistency of assessments by the assessors for whom they are responsible. Internal verifiers therefore need to have a thorough understanding of quality assurance and assessment practices, as well as technical competence related to the qualifications that they are internally verifying.

Internal verifiers will be responsible for, and accountable for consistency, quality and reliability of evidence and assessors.

It will be the responsibility of the approved centre to select and appoint internal verifiers.

It will be the responsibility of the Awarding Organisation to approve centre selected internal verifiers.

To be an approved internal verifier the person must:-

- have in-depth knowledge of the occupational standards and credit-based unit evidence requirements.
- be occupationally aware of the relevant industry sector being internally verified
- hold or be working towards a relevant verifier award as specified by the Institute of the Motor Industry. This will include, but not be limited to the Quality Assurance qualifications Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practice, Level 4 Certificate in Leading the Internal Quality Assurance of Assessment Processes and Practice, (and by implication legacy Internal Verifier unit V1 D34 unit) but may be an appropriate equivalent as defined by the SSC.
- verifiers working towards a relevant qualification must achieve their qualification within 12 months.
- provide evidence of CPD totalling not less than 30 hours from within their professional area within a 12 month period.
- be approved by the Awarding Organisation to carry out internal verification for relevant VCQ(s)
- demonstrate knowledge and understanding of the quality assurance processes required by the centre and the awarding organisation

Approval of internal verifiers can be **removed**.

Internal Verifiers **cannot** verify the VCQ if they are not approved by, or have had their approval removed by the Awarding Organisation.

### **Multi Discipline Assessors and Internal Verifiers**

Assessors and Internal Verifiers who work across multi disciplines must agree to a programme of CPD that will, over an agreed period of time, show their competence across all areas that they assess.

The programme of CPD and the timescale must be agreed for each multi discipline assessor by their External Verifier and may be subject to scrutiny by the IMI.

It is the responsibility of the centre to keep a record of these agreements.

## External Verifier Requirements.

Awarding Organisations will be responsible for selection and appointment of external verifiers.

To be an approved external verifier or moderator the person must:-

- hold or be working towards an appropriate qualification as specified by the Institute of the Motor Industry, confirming their competence to externally verify VCQ assessments This will include, but not be limited to the Level 4 Award in Externally Assuring the Quality of Assessment Processes and Practice, Level 4 Certificate in Leading the External Quality Assurance of Assessment Processes and Practice, (and by implication legacy External Verifier unit V2 and D35 units) but may be an appropriate equivalent as defined by the SSC.
- external verifiers working towards a relevant qualification must achieve their qualification within 12 months.
- have experience of working within the automotive industry gained through current or prior employment in order to have an up- to- date technical awareness relevant to the VCQ they are seeking to externally verify
- have a sound and in-depth knowledge of the VCQ requirements
- demonstrate their commitment to maintaining their industry knowledge by providing evidence of CPD totalling not less than 30 hours from within their professional area within a 12 month period.

## External Quality Control.

It is expected that the awarding of qualifications will be underpinned by quality assurance appropriate to workplace based delivery. At a minimum this should reflect the principles outlined below.

External quality control of assessment is the responsibility of the Awarding Organisations, they must ensure that common approaches are employed and that consistent, high standards are achieved.

External verifiers will be required to implement rigorous risk management strategies consistently across all centres for which they are responsible.

IMI recommends that Awarding Organisations adopt a risk rating and risk management system for centres offering IMI VCQs.

IMI recommend that such systems identify:

- commercial risk – is there potential for commercial pressures to ensure that candidates achieve qualifications within unduly short time frames?
- assessment/verification risk – are factors apparent in the relationship between candidates, assessors and verifiers that might prejudice a fair and consistent assessment process?

Where risks or potential risks are identified, IMI expects that the Awarding Organisation, via the external verifier takes appropriate action to ensure that the credibility of the assessment process is not prejudiced.

Awarding Organisations will be responsible for and accountable for the quality of VCQs delivered and assessed by their approved assessment centres.

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