QUALIFICATION HANDBOOK

Level 2 and Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence (4270-22/23)

October 2013 Version 1.2

City & Guilds

Qualification at a glance

Subject area	**Heavy Vehicle Maintenance and Repair**
City & Guilds number	4270
Age group approved	16-18 19+
Assessment	Portfolio of Evidence, Online Multiple Choice and Assignments
Fast track	Not available. Automatic approval applies in some cases.
Support materials	Centre handbook Practical Assessment workbook Practical training workbook
Registration and Certification	See online/Walled Garden for last Registration and Certification dates

Title and level	City & Guilds number	Accreditation number
Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence	4270-22	501/0745/8
Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence	4270-23	500/9984/X

Version and date	Change detail	Section
1.1 Dec 2012	Range added 058, 254, 456, 263, 271 Range deleted 261, 262 GLH amend 213 UAN change 221	**Various**
1.2 Oct 2013	Unit supporting information updated with introductory text	**Units**

Contents

1	**Introduction**	**6**
	Structure	7
2	**Centre requirements**	**10**
	Approval	10
	Resource requirements	10
	Candidate entry requirements	12
3	**Delivering the qualification**	**13**
	Initial assessment and induction	13
	Support materials	13
	Recording documents	13
	Health and safety	13
	Data protection and confidentiality	14
	Initial assessment and induction	14
	Equal opportunities	14
	Access to assessment	14
	Appeals	15
4	**Assessment**	**16**
	Recognition of prior learning (RPL)	16
5	**Units**	**19**
Unit 001	**Competency in health, safety and good housekeeping in the automotive environment**	**20**
Unit 003	**Competency in supporting job roles in the automotive work environment**	**23**
Unit 004	**Skills in materials, fabrication, tools and measuring devices used in the automotive environment**	**26**
Unit 006	**Competency in making learning possible through demonstrations and instruction**	**29**
Unit 008	**Competency in identifying and agreeing motor vehicle customer service needs**	**32**
Unit 051	**Knowledge of health, safety and good housekeeping in the automotive environment**	**35**
Unit 053	**Knowledge of support for job roles in the automotive work environment**	**43**
Unit 054	**Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment**	**47**
Unit 056	**Knowledge of how to make learning possible through demonstrations and instruction**	**51**
Unit 058	**Knowledge of how to identify and agree motor vehicle customer service needs**	**57**

Unit 201	**Competency in conducting routine heavy vehicle maintenance**	**61**
Unit 202	**Competency in removing and replacing heavy vehicle engine units and components**	**65**
Unit 203	**Competency in removing and replacing heavy vehicle electrical units and components**	**68**
Unit 204	**Competency in removing and replacing heavy vehicle chassis units and components**	**71**
Unit 205	**Competency required to inspect heavy vehicles using prescribed methods**	**74**
Unit 206	**Competency required to inspect heavy vehicles to comply with legal requirements**	**77**
Unit 207	**Competency in diagnosing and rectifying heavy vehicle engine faults**	**80**
Unit 208	**Competency in diagnosing and rectifying heavy vehicle chassis system faults**	**83**
Unit 211	**Competency in overhauling heavy vehicle engine mechanical units**	**86**
Unit 212	**Competence in removing and replacing heavy vehicle transmission and driveline units and components**	**89**
Unit 213	**Competency in diagnosing and rectifying heavy vehicle transmission and driveline faults**	**93**
Unit 221	**Competency in overhauling heavy vehicle transmission units**	**96**
Unit 231	**Competency in overhauling heavy vehicle steering and suspension units**	**99**
Unit 251	**Knowledge of conducting routine heavy vehicle maintenance**	**102**
Unit 252	**Knowledge of heavy vehicle engine mechanical, lubrication and cooling system units and components**	**106**
Unit 253	**Knowledge of removing and replacing heavy vehicle electrical units and components**	**113**
Unit 254	**Knowledge of removing and replacing heavy vehicle chassis units and components**	**119**
Unit 255	**Knowledge of inspecting heavy vehicles**	**130**
Unit 257	**Knowledge of diagnosis and rectification of heavy vehicle engine faults**	**134**
Unit 258	**Knowledge of diagnosis and rectification of heavy vehicle chassis faults**	**143**
Unit 261	**Knowledge of overhauling heavy vehicle engine mechanical units**	**150**
Unit 262	**Knowledge of heavy vehicle transmission and driveline units and components**	**152**
Unit 263	**Knowledge of diagnosis and rectification of heavy transmission and driveline faults**	**160**

Unit 271	**Knowledge of overhauling heavy vehicle transmission units**	**166**
Unit 272	**Knowledge of heavy vehicle fuel, air supply and exhaust system units and components**	**169**
Unit 281	**Knowledge of overhauling heavy vehicle steering and suspension units**	**175**
Unit 406	**Competency in diagnosing and rectifying vehicle auxiliary electrical faults**	**178**
Unit 456	**Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults**	**182**
Appendix 1	**Sources of general information**	**192**

1 Introduction

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

Area	Description
Who are the qualifications for?	These Levels 2 and 3 Diplomas in Heavy Vehicle Maintenance and Repair Competence are for anyone developing a career in the motor industry. These practical qualifications demonstrate your skills on the job, in your own workplace, showing that you meet national standards for automotive workers. Their structure and assessment strategy have been produced by the Institute of the Motor Industry, who are the Sector Skills Council for the Automotive Industry.
What do the qualifications cover?	Candidates cover areas such as heavy vehicle maintenance, removal and replacement of vehicle units and components and diagnosis and rectification of vehicle faults. They are assessed in the workplace by using the following methods: • workplace observation • witness testimony • verbal questioning of essential knowledge • City & Guilds' GOLA multiple choice test
Are the qualifications part of a framework or initiative?	These qualifications are part of the Automotive Maintenance and Repair Intermediate level Apprenticeship and Advanced Apprenticeship Frameworks (framework 1) which will replace current framework 4 from April 2011.
What opportunities for progression are there?	After taking these qualifications candidates will have a qualification that show employers and customers they have the skills of a competent technician and will be able to progress into employment. In addition, candidates who enjoy leading teams of people at work could also move onto a qualification as a Team Leader or Supervisor such as qualifications at Levels 2, 3 and 4 through the Institute of Leadership and Management (ILM).

Structure

To achieve the **Level 2 Diploma in Heavy Vehicle Maintenance & Repair**, learners must achieve **92** credits from the mandatory units and a minimum of **9** credits from the optional units available, both units from any optional group must be taken.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Mandatory			
A/601/6338	001	Competency in health, safety and good housekeeping in the automotive environment	7
K/601/6366	003	Competency in supporting job roles in the automotive work environment	5
Y/601/6279	004	Skills in materials, fabrication, tools and measuring devices in the automotive environment	7
D/601/6171	051	Knowledge of health, safety and good housekeeping in the automotive environment	3
T/601/6175	053	Knowledge of support for job roles in the automotive work environment	3
K/601/6237	054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	4
L/601/4903	201	Competency in conducting routine heavy vehicle maintenance	7
R/601/4904	202	Competency in removing and replacing heavy vehicle engine units and components	10
Y/601/4905	203	Competency in removing and replacing heavy vehicle electrical units and components	10
M/601/7356	204	Competency in removing and replacing heavy vehicle chassis units and components	10
J/601/4933	251	Knowledge of conducting routine heavy vehicle maintenance	2
D/601/4937	252	Knowledge of heavy vehicle engine mechanical, lubrication and cooling system units and components	3
J/601/4947	253	Knowledge of removing and replacing heavy vehicle electrical units and components	6
L/601/4951	254	Knowledge of heavy vehicle removing and replacing chassis units and components	6
F/601/4963	262	Knowledge of heavy vehicle transmission and driveline units and components	6

Unit accreditation number	City & Guilds unit	Unit title	Credit value
T/601/4944	272	Knowledge of heavy vehicle fuel, air supply and exhaust system units and components	3
Optional		**Group 1**	
D/601/4906	205	Competency required to inspect heavy vehicles using prescribed methods	5
Y/601/4967	255	Knowledge of inspecting heavy vehicles	4
Optional		**Group 2**	
M/601/4926	212	Competence in removing and replacing heavy vehicle transmission and driveline units and components	10

To achieve the **Level 3 Diploma in Heavy Vehicle Maintenance & Repair**, learners must achieve **92** credits from the mandatory units and a minimum of **10** credits from the optional groups available, both units from any optional group must be taken.

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Mandatory			
A/601/6338	001	Competency in health, safety and good housekeeping in the automotive environment	7
K/601/6366	003	Competency in supporting job roles in the automotive work environment	5
Y/601/6279	004	Skills in materials, fabrication, tools and measuring devices in the automotive environment	7
D/601/6171	051	Knowledge of health, safety and good housekeeping in the automotive environment	3
T/601/6175	053	Knowledge of support for job roles in the automotive work environment	3
K/601/6237	054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	4
H/601/4910	206	Competency required to inspect heavy vehicles to comply with legal requirements	5
M/601/4912	207	Competency in diagnosing and rectifying heavy vehicle engine faults	10
A/601/4914	208	Competency in diagnosing and rectifying heavy vehicle chassis system faults	10
Y/601/4967	255	Knowledge of inspecting heavy vehicles	4

Unit accreditation number	City & Guilds unit	Unit title	Credit value
Y/601/4953	257	Knowledge of diagnosis and rectification of heavy vehicle engine faults	6
K/601/4956	258	Knowledge of diagnosis and rectification of heavy vehicle chassis faults	6
L/601/4965	263	Knowledge of diagnosis and rectification of heavy transmission and driveline faults	6
L/601/3749	406	Competency in the diagnosing and rectifying vehicle auxiliary electrical faults	10
A/601/3746	456	Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults	6
Optional		**Group 1**	
Y/601/6380	006	Competency in making learning possible through demonstrations and instruction	5
T/601/6242	056	Knowledge of how to make learning possible through demonstrations and instruction	5
Optional		**Group 2**	
K/601/6383	008	Competency in identifying and agreeing motor vehicle customer service needs	5
R/601/6247	058	Knowledge of how to identify and agree motor vehicle customer service needs	5
Optional		**Group 3**	
L/601/4917	211	Competency in overhauling heavy vehicle engine mechanical units	6
M/601/4957	261	Knowledge of overhauling heavy vehicle engine mechanical units	5
Optional		**Group 4**	
R/601/4921	221	Competency in overhauling heavy vehicle transmission units	6
A/601/4959	271	Knowledge of overhauling heavy vehicle transmission units	4
Optional		**Group 5**	
H/601/4924	231	Competency in overhauling heavy vehicle steering and suspension units	6
T/601/4961	281	Knowledge of overhauling heavy vehicle steering and suspension units	4
Optional		**Group 6**	
F/601/4929	213	Competency in diagnosing and rectifying heavy vehicle transmission and driveline faults	10

2 Centre requirements

Approval

If your Centre is approved to offer qualification Level 2 NVQ in Automotive Maintenance and Repair – Heavy Vehicle (4101-02) you will be granted automatic approval for Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence (4270-22) and will be able to make registrations straight away.

In regards to the Level 3, the Level 3 NVQ in Automotive Maintenance and Repair - Heavy Vehicle (4101-07) will provided you with automatic approval for Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence (4270-23).

For any other cases, centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Resource requirements

Physical resources and site agreements

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

Centre staffing

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

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

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

Assessors and internal verifiers

All assessors 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 Sector Skills Council. This will include, but not be limited to the Assessor qualifications, Level 3 Award in Understanding the Principles and Practices of Assessment, 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 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).

All internal verifiers 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 Sector Skills Council. This will include, but not be limited to the Quality Assurance qualifications Level 4 Award in Understanding the Internal Quality Assurance of Assessment Processes and Practice, 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 Sector Skills Council.
    - 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.

Continuing professional development (CPD)

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

Candidate entry requirements

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

Age restrictions

There is no age restriction for these qualifications unless this is a legal requirement of the process or the environment.

3 Delivering the qualification

Initial assessment and induction

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

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

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

Support materials

City & Guilds will provide the following learning and support resources which will be posted on our website.
www.cityandguilds.com/automotive

- Practical assessment workbook
- Practical training workbook.

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

To support the delivery of vocational qualifications we offer our own ePortfolio, Learning Assistant, an easy to use and secure online tool to support and evidence candidates' progress towards achieving qualifications. Further details are available at:
www.cityandguilds.com/eportfolios.

City & Guilds has developed training and assessment documentation specifically for these qualifications which are available from City & Guilds website. Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre.

Health and safety

The requirement to follow safe working practices is an integral part of all City & Guilds qualifications and assessments, and it is the responsibility of centres to ensure that all relevant health and safety requirements are in place before candidates start practical assessments.

Should a candidate fail to follow health and safety practice and procedures during an assessment, the assessment must be stopped. The candidate should be informed that they have not reached the standard required to successfully pass the assessment and told the reason why. Candidates may retake the assessment at a later date, at the discretion of the centre. In case of any doubt, guidance should be sought from the external verifier.

Data protection and confidentiality

Centres offering this qualification may need to provide City & Guilds with personal data for staff and candidates. Guidance on data protection and the obligations of City & Guilds and centres are explained in *Centre Manual - Supporting Customer Excellence*.

Initial assessment and induction

Centres will need to make an initial assessment of each candidate prior to the start of their programme to ensure they are entered for an appropriate type and level of qualification. The initial assessment should identify any specific training needs the candidate may have, and the support and guidance they may require when working towards their qualification.

City & Guilds recommends that centres provide an induction programme to ensure the candidate fully understands the requirements of the qualification they will work towards, their responsibilities as a candidate, and the responsibilities of the centre. It may be helpful to record the information on a learning contract.

Further guidance about initial assessment and induction, as well as a learning contract that centres may use, are available in the *Centre Manual - Supporting Customer Excellence*.

Equal opportunities

It is a requirement of centre approval that centres have an equal opportunities policy (see *Centre Manual - Supporting Customer Excellence)*. The regulatory authorities require City & Guilds to monitor centres to ensure that equal opportunity policies are being followed.

The City & Guilds equal opportunities policy is set out on the City & Guilds website, in *Centre Manual - Supporting Customer Excellence*, and is also available from the City & Guilds Customer Relations department.

Access to qualifications on the Qualifications Credit Framework is open to all, irrespective of gender, race, creed, age or special needs. The centre co-ordinator should ensure that no candidate is subject to unfair discrimination on any ground in relation to access to assessment and the fairness of the assessment.

Access to assessment

City & Guilds' guidance and regulations on access to assessment are designed to facilitate access to assessments and qualifications for candidates who are eligible for adjustments to assessment arrangements. Access arrangements are designed to allow attainment to be demonstrated. For further information, please see *Access to assessment and qualifications*, available on the City & Guilds website.

Appeals

Centres must have their own, auditable, appeals procedure that must be explained to candidates during their induction. Appeals must be fully documented by the quality assurance co-ordinator and made available to the external verifier or City & Guilds.

Further information on appeals is given in *Centre Manual - Supporting Customer Excellence*. There is also information on appeals for centres and learners on the City & Guilds website or available from the Customer Relations department.

4 Assessment

Candidates must complete

- Online multiple choice tests.
- A portfolio of evidence
- Assessments

Time constraints

There are no time constraints applied to the assessment of this qualification. If centres have queries regarding the length of time required to complete a particular task, they should contact their external verifier in the first instance who will advise accordingly and feed this information back to City & Guilds where appropriate.

Recognition of prior learning (RPL)

Recognition of prior learning means using a learner's previous experience, or qualifications which have already been achieved, to contribute to a new qualification.

RPL is allowed and is also sector specific.

Full details of the assessment requirements and the assessment strategy relating to these qualifications can be obtained directly from the Institute of the Motor Industry (IMI) **http://www.motor.org.uk**

Level 2 Diploma in Heavy Vehicle Maintenance and Repair Competence

Unit number	Unit title	Assessment method
001	Competency in health, safety and good housekeeping in the automotive environment	Assignment
003	Competency in supporting job roles in the automotive work environment	Assignment
004	Skills in materials, fabrication, tools and measuring devices in the automotive environment	Assignment
051	Knowledge of health, safety and good housekeeping in the automotive environment	Assignment
053	Knowledge of support for job roles in the automotive work environment	Assignment
054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	Assignment
201	Competency in conducting routine heavy vehicle maintenance	Portfolio

202	Competency in removing and replacing heavy vehicle engine units and components	Portfolio
203	Competency in removing and replacing heavy vehicle electrical units and components	Portfolio
204	Competency in removing and replacing heavy vehicle chassis units and components	Portfolio
205	Competency required to inspect heavy vehicles using prescribed methods	Portfolio
212	Competency in removing and replacing heavy vehicle transmission and driveline units and components	Portfolio
251	Knowledge of conducting routine heavy vehicle maintenance	Multiple Choice
252	Knowledge of heavy vehicle engine mechanical, lubrication and cooling system units and components	Multiple Choice
253	Knowledge of removing and replacing heavy vehicle electrical units and components	Multiple Choice
254	Knowledge of heavy vehicle removing and replacing chassis units and components	Multiple Choice
255	Knowledge of inspecting heavy vehicles	Multiple Choice
262	Knowledge of heavy vehicle transmission and driveline units and components	Multiple Choice
272	Knowledge of heavy vehicle fuel, air supply and exhaust system units and components	Multiple Choice

Level 3 Diploma in Heavy Vehicle Maintenance and Repair Competence

Unit number	Unit title	Assessment method
001	Competency in health, safety and good housekeeping in the automotive environment	Assignment
003	Competency in supporting job roles in the automotive work environment	Assignment
004	Skills in materials, fabrication, tools and measuring devices in the automotive environment	Assignment
006	Competency in making learning possible through demonstrations and instruction	Assignment
008	Competency in identifying and agreeing motor vehicle customer service needs	Assignment
051	Knowledge of health, safety and good housekeeping in the automotive environment	Assignment
053	Knowledge of support for job roles in the automotive work environment	Assignment
054	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	Assignment

056	Knowledge of how to make learning possible through demonstrations and instruction	Assignment
058	Knowledge of how to identify and agree motor vehicle customer service needs	Assignment
206	Competency required to inspect heavy vehicles to comply with legal requirements	Portfolio
207	Competency in diagnosing and rectifying heavy vehicle engine faults	Portfolio
208	Competency in diagnosing and rectifying heavy vehicle chassis system faults	Portfolio
211	Competency in overhauling heavy vehicle engine mechanical units	Portfolio
213	Competency in diagnosing and rectifying heavy vehicle transmission and driveline faults	Portfolio
221	Competency in overhauling heavy vehicle transmission units	Portfolio
231	Competency in overhauling heavy vehicle steering and suspension units	Portfolio
255	Knowledge of inspecting heavy vehicles	Multiple Choice
257	Knowledge of diagnosis and rectification of heavy vehicle engine faults	Multiple Choice
258	Knowledge of diagnosis and rectification of heavy vehicle chassis faults	Multiple Choice
261	Knowledge of overhauling heavy vehicle engine mechanical units	Multiple Choice
263	Knowledge of diagnosis and rectification of heavy transmission and driveline faults	Multiple Choice
271	Knowledge of overhauling heavy vehicle transmission units	Multiple Choice
281	Knowledge of overhauling heavy vehicle steering and suspension units	Multiple Choice
406	Competency in the diagnosing and rectifying vehicle auxiliary electrical faults	Portfolio
456	Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults	Multiple Choice

5 Units

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria

Unit 001 Competency in health, safety and good housekeeping in the automotive environment

UAN:	**A/601/6338**
Level:	Level 2
Credit value:	7
GLH:	60
Relationship to NOS:	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environments.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit helps the learner to develop the skills required to carry out the routine maintenance and cleaning of the automotive environment and to use resources economically. Also to adhere to 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.

Learning outcome	**The learner will:**
1. be able to use correct personal and vehicle protection within the automotive work environment	
Assessment criteria	
The learner can: 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	

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

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

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

Unit 001 Competency in health, safety and good housekeeping in the automotive environment

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 003 Competency in supporting job roles in the automotive work environment

UAN:	**K/601/6366**
Level:	Level 3
Credit value:	5
GLH:	40
Relationship to NOS:	This unit is linked to G3 Maintain Working Relationships in the Motor Vehicle Environment.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

Learning outcome	The learner will:
3. be able to communicate with and support colleagues and customers effectively within the automotive work environment	
Assessment criteria	
The learner can: 3.1 use methods of communication with customers and colleagues which meet their needs 3.2 give customers and colleagues accurate information 3.3 make requests for assistance from or to customers and colleagues clearly and courteously 3.4 report any anticipated delays in completion to the relevant persons promptly.	

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

Unit 003 Competency in supporting job roles in the automotive work environment

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 004 Skills in materials, fabrication, tools and measuring devices used in the automotive environment

UAN:	**Y/601/6279**
Level:	Level 2
Credit value:	7
GLH:	60
Relationship to NOS:	This unit is linked to G4 Use of Hand Tools and Equipment in Motor Vehicle Engineering.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

Learning outcome	The learner will:
4. be able to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	
Assessment criteria	
The learner can: 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.	

Unit 004 Skills in materials, fabrication, tools and measuring devices used in the automotive environment

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 006 Competency in making learning possible through demonstrations and instruction

UAN:	**Y/601/6380**
Level:	Level 3
Credit value:	5
GLH:	40
Relationship to NOS:	This unit is linked to G6 Enable Learning through Demonstration and Instruction.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit will help the learner to develop competency in order to carry out demonstrations and instruction. 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.

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

Learning outcome	The learner will:
2. be able to instruct learners	
Assessment criteria	
The learner can: 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.	

Unit 006 Competency in making learning possible through demonstrations and instruction

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 008 Competency in identifying and agreeing motor vehicle customer service needs

UAN:	**K/601/6383**
Level:	Level 3
Credit value:	5
GLH:	40
Relationship to NOS:	This unit is linked to G8 Identify and Agree the Motor Vehicle Customer Needs.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

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

Unit 008 Competency in identifying and agreeing motor vehicle customer service needs

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 051 Knowledge of health, safety and good housekeeping in the automotive environment

UAN:	**D/601/6171**
Level:	Level 2
Credit value:	3
GLH:	30
Relationship to NOS:	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environments and G2 Reduce Risks to Health and Safety in the Motor Vehicle Environment.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

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

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

Unit 051 Knowledge of health, safety and good housekeeping in the automotive environment

Supporting information

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

Economic use of Resources

a. Consumable materials e.g. grease, oils, split pins, locking and fastening devices.

Requirement to maintain work area effectively

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

Spillages, leaks and waste materials

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

Basic legislative requirements

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

Routine maintenance of the workplace

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

Legislation relevant to Health and Safety

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

General regulations to include an awareness of:

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

Legislative duties

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

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

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

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

PPE to include:

a. typical maintenance procedures for PPE equipment to include:
    i typical maintenance log
    ii cleaning procedures
    iii filter maintenance
    iv variation in glove types
    v air quality checks.
b. choice and fitting procedures for masks and air breathing equipment.
c. typical workplace processes which would require the use of PPE to include:
    i. welding
    ii. sanding and grinding
    iii. filling
    iv. panel removal and replacement
    v. drilling
    vi. cutting
    vii. chiselling
    viii. removal of broken glass
    ix. removal of rubber seals from fire damaged vehicles
    x. removal of hypodermic needles
    xi. servicing activities
    xii. roadside recovery.

d.unserviceable PPE.

e PPE required for a range of automotive repair activities. To include appropriate protection of:

    i eyes
    ii ears
    iii head
    iv skin
    v feet
    vi hands
    vii lungs.

Fire and extinguishers

a. Classification of fire types.

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

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

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

Product warning labels to include:

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

Warning signs and notices

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

Hazards and risks to include:

a. the difference between a risk and a hazard.
b. potential risks resulting from:
    i. the use and maintenance of machinery or equipment
    ii. the use of materials or substances
    iii. accidental breakages and spillages
    iv. unsafe behaviour
    v. working practices that do not conform to laid down policies
    vi. environmental factors
    vii. personal presentation
    viii. unauthorised personnel, customers, contractors etc entering the work premises

ix. working by the roadside
x. vehicle recovery.

c. the employee's responsibilities in identifying and reporting risks within their working environment.
d. the method of reporting risks that is outside own limits of authority.
e. potential causes of:
    i. fire
    ii. explosion
    iii. noise
    iv. harmful fumes
    v. slips
    vi. trips
    vii. falling objects
    viii. accidents whilst dealing with broken down vehicles.

Personal responsibilities

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

Action to be taken in the event of colleagues suffering accidents

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

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

UAN:	**T/601/6175**
Level:	Level 3
Credit value:	3
GLH:	20
Relationship to NOS:	This unit is linked to G3 Maintaining Working Relationships in the Motor Vehicle Environment.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

Learning outcome	**The learner will:**
1. understand key organisational structures, functions and roles within the automotive work environment	
Assessment criteria	
The learner can: 1.1 identify the purpose of the main 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.	

Learning outcome	**The learner will:**
2. understand the importance of obtaining, interpreting and using information in order to support their job role within the automotive work environment	
Assessment criteria	
The learner can: 2.1 explain the importance of different sources of information in an automotive work environment.	

2.2 explain how to find, interpret and use relevant sources of information. 2.3 describe the main legal requirements relating to the vehicle, including road safety requirements 2.4 explain the importance of working to recognised procedures and processes 2.5 explain when replacement units and components must meet the manufacturers' original equipment specification. 2.6 explain the purpose of how to use identification codes.

Learning outcome	**The learner will:**
3. understand the importance of different types of communication within the automotive work environment	
Assessment criteria	
The learner can: 3.1 explain where the 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 people and informed people	

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

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

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

Supporting information

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

The structure of a typical vehicle repair business

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

Sources of information:

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

Communication requirements when carrying out vehicle repairs

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

iii. memos
iv. telephone
v. electronic mail
vi. vehicle job card
vii. notice boards
viii. SMS text messaging
ix. letters.

d. Organisational & Customer requirements:
   i. importance of time scales to customer and organization
   ii. relationship between time and costs
   iii. meaning of profit
e. Choice of communication
   i. distance
   ii. location
   iii. job responsibility.
f. Importance of maintaining positive working relationships:
   i. morale
   ii. productivity
   iii. company image
   iv. customer relationships
   v. colleagues.

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

UAN:	**K/601/6237**
Level:	Level 2
Credit value:	4
GLH:	40
Relationship to NOS:	This unit is linked to G4 Use of Hand Tools and Equipment in Motor Vehicle Engineering.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

1.5 explain how common hand tools and measuring devices used for fabricating, repair and fitting in the automotive environment should be stored and maintained 1.6 identify common electrical measuring tools used in the repair of vehicles and components. 1.7 explain the preparation and safe and correct use of common electrical tools when measuring voltage, current and resistance.

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

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

Learning outcome	**The learner will:**
4. understand how to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	
Assessment criteria	
The learner can: 4.1 describe how to tap threads, file, cut and drill plastics and metals when modifying and 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.	

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

Supporting information

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

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

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

Common measuring devices used for fabrication and fitting in the automotive workplace to include:

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

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

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

Common electrical terms when measuring:

a. voltage
b. current
c. resistance.

Workshop equipment (including appropriate PPE) to include:

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

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

Materials to include:

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

The properties, application and limitations (to include safe use) of non-metallic materials used when constructing modifying and repairing vehicles and components

Materials to include:

a. glass
b. plastics (including 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.

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

UAN:	**T/601/6242**
Level:	Level 3
Credit value:	5
GLH:	45
Relationship to NOS:	This unit is linked to G6 Enable Learning Through Demonstration and Instruction.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

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

Supporting information

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

Separate areas of demonstration which encourage learning

To include:

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

Types of learning which are best achieved and supported through demonstrations

To include:

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

How to structure demonstration and instruction sessions

To include:

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

vii consider how to emphasise safe working practices

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

c. After the demonstration (if possible)
   i enable the audience to 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 learner's progress and understanding.

Instructional techniques

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

Environmental factors that 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 affect learning

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

Analysis of demonstration/instruction

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

Developments in learning

To include:

a. multimedia based materials
b. web based materials
c. interactive materials

How to choose and prepare appropriate materials.

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

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

UAN:	**R/601/6247**
Level:	Level 3
Credit value:	5
GLH:	45
Relationship to NOS:	This unit is linked to G8 Identify and Agree the Motor Vehicle Customer Needs.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

Supporting information

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

Organisational Requirements

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

Principles of Customer Communication and Care

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

Company Products and Services

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

iii. repair.
iv. warranty.
v. MOT testing.
vi. fitment of accessories/enhancements.
vii. internal.

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

Vehicle Information Systems, Servicing and Repair Requirements

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

Consumer Legislation To include:

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

Unit 201 Competency in conducting routine heavy vehicle maintenance

UAN:	**L/601/4903**
Level:	Level 2
Credit value:	7
GLH:	60
Relationship to NOS:	This unit is linked to HV01 Carry Out Routine Motor Vehicle Maintenance.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the Automotive Retail Industry.
Aim:	This unit allows the learner to develop skills they can carry out light vehicle routine maintenance, adjustments and replacement activities as part of the periodic servicing of vehicles.

Learning outcome	**The learner will:**
1. be able to work safely when carrying out heavy vehicle routine maintenance	
Assessment criteria	
The learner can: 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.	

Learning outcome	**The learner will:**
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 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.	

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out heavy vehicle routine maintenance	
Assessment criteria	
The learner can: 4.1 carry out heavy vehicle maintenance using prescribed methods, adhering to the correct specifications and tolerances for the vehicle and following: a. the manufacturer's approved inspection methods b. recognised researched inspection methods c. health and safety requirements 4.2 carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer's current specification for: a. the particular service interval b. working methods and procedures c. use of equipment d. the tolerances for the vehicle. 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: a. differences from the vehicle specification b. vehicle appearance and condition faults 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.	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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.	

Unit 201 Competency in conducting routine heavy vehicle maintenance

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 202 Competency in removing and replacing heavy vehicle engine units and components

UAN:	**R/601/4904**
Level:	Level 2
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV02 Remove and Replace Motor Vehicle Engine Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to develop skills to remove and replace light vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	**The learner will:**
1. be able to work safely when carrying out removal and replacement activities	
Assessment criteria	
The learner can: 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.	

Learning outcome	**The learner will:**
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 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.	

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out removal and replacement of heavy vehicle engine units and components	
Assessment criteria	
The learner can: 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 4.5 complete all system diagnostic activities within the agreed timescale.	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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.	

Unit 202 Competency in removing and replacing heavy vehicle engine units and components

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 203 Competency in removing and replacing heavy vehicle electrical units and components

UAN:	**Y/601/4905**
Level:	Level 2
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV03 Remove and Replace Motor Vehicle Electrical Auxiliary Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to develop skills to remove and replace light vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	**The learner will:**
1. be able to work safely when carrying out removal and replacement activities	
Assessment criteria	
The learner can: 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.	

Learning outcome	**The learner will:**
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 2.1 select suitable sources of technical information to support heavy vehicle electrical 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 electrical unit and component removal and replacement activities	

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out removal and replacement of heavy vehicle electrical units and components.	
Assessment criteria	
The learner can: 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.	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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.	

Unit 203 Competency in removing and replacing heavy vehicle electrical units and components

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 204 Competency in removing and replacing heavy vehicle chassis units and components

UAN:	**M/601/7356**
Level:	Level 2
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV04 Remove and Replace Commercial Motor Vehicle Chassis Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can 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

Learning outcome	**The learner will:**
1. be able to work safely when carrying out removal and replacement activities	
Assessment criteria	
The learner can: 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.	

Learning outcome	**The learner will:**
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 2.1 select suitable sources of technical information to support heavy vehicle chassis 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 chassis unit and component removal and replacement activities	

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out removal and replacement of heavy vehicle chassis units and components.	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 . make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 204 Competency in removing and replacing heavy vehicle chassis units and components

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 205 Competency required to inspect heavy vehicles using prescribed methods

UAN:	**D/601/4906**
Level:	Level 2
Credit value:	5
GLH:	40
Relationship to NOS:	This unit is linked to HV05 Inspect Motor Vehicles using Prescribed Inspection Methods.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can carry out a range of inspections on heavy vehicles using a variety of prescribed testing and inspection methods.

Learning outcome	**The learner will:**
1. be able to work safely when carrying out heavy vehicle inspections using prescribed methods	
Assessment criteria	
The learner can: 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	

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

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 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 outcome	The learner will:
4. be able to carry out heavy vehicle inspections using prescribed methods	
Assessment criteria	
The learner can: 4.1 carry out heavy vehicle inspections using prescribed methods, adhering to the specifications and tolerances for the vehicle and following: a. the manufacturer's approved inspection methods b. recognised researched inspection methods c. health and safety requirements d. prescribed documentation 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: a. differences from the vehicle specification b. vehicle appearance and condition faults 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 outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 205 Competency required to inspect heavy vehicles using prescribed methods

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 206 Competency required to inspect heavy vehicles to comply with legal requirements

UAN:	**H/601/4910**
Level:	3
Credit value:	5
GLH:	40
Relationship to NOS:	This unit is linked to HV06C Demonstrating Competency in Inspecting Heavy Vehicles to Comply with Legal Requirements
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can carry out a range of heavy vehicle legal compliance inspections using a variety of methods.

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

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

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 3.1 select the appropriate tools and equipment necessary for carrying out a range of inspections on heavy systems including: a. pre MOT inspection b. scheduled safety inspections (PMI) 3.2 ensure that equipment has been calibrated to meet manufacturer's and legal requirements 3.3 use the tools and equipment in a way specified by manufacturer's when carrying out a range of inspections on heavy vehicle systems	

Learning outcome	The learner will:
4. be able to carry out heavy vehicle inspections	
Assessment criteria	
The learner can: 4.1 carry out heavy vehicle inspections, adhering to the specifications and tolerances for the vehicle and the following: a. the manufacturer's approved inspection methods b. recognised researched inspections methods c. health and safety requirements d. workplace procedures 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	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable 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	

Unit 206 Competency required to inspect heavy vehicles to comply with legal requirements

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 207 Competency in diagnosing and rectifying heavy vehicle engine faults

UAN:	**M/601/4912**
Level:	Level 3
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV07 Diagnose and Rectify Motor Vehicle Engine and Component Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can diagnose and rectify heavy vehicle engine mechanical, electrical, hydraulic and fluid systems faults.

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

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

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

Learning outcome	The learner will:
4. be able to carry out heavy vehicle engine diagnosis, rectification and test activities	
Assessment criteria	
The learner can: 4.1 use diagnostic methods that are relevant to the symptoms presented 4.2 evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately 4.3 carry out all diagnostic and rectification activities following: 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 outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 207 Competency in diagnosing and rectifying heavy vehicle engine faults

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 208 Competency in diagnosing and rectifying heavy vehicle chassis system faults

UAN:	**A/601/4914**
Level:	3
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV08 Diagnose and Rectify Motor Vehicle Chassis System Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can diagnose and rectify heavy vehicle braking steering and suspension systems faults. It also covers the evaluation of performance of the replaced or repaired units and systems.

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

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

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

Learning outcome	The learner will:
4. be able to carry out heavy vehicle chassis diagnosis, rectification and test activities	
Assessment criteria	
The learner can: 4.1 use diagnostic methods that are relevant to the symptoms presented 4.2 evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately 4.3 carry out all diagnostic and rectification activities following: 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 outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 208 Competency in diagnosing and rectifying heavy vehicle chassis system faults

Supporting information

Evidence Requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 211 Competency in overhauling heavy vehicle engine mechanical units

UAN:	**L/601/4917**
Level:	Level 3
Credit value:	6
GLH:	50
Relationship to NOS:	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

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

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

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

Learning outcome	The learner will:
4. be able to carry out the overhauling of heavy vehicle engine mechanical units	
Assessment criteria	
The learner can: 4.1 carry out all overhauling of heavy vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following: 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. 4.7 complete all system diagnostic activities within the agreed timescales	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 211 Competency in overhauling heavy vehicle engine mechanical units

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 212 Competence in removing and replacing heavy vehicle transmission and driveline units and components

UAN:	**M/601/4926**
Level:	Level 2
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV12 Remove and Replace Commercial Motor Vehicle Transmission Driveline Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can remove and replace heavy vehicle transmission and driveline units. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	**The learner will:**
1. be able to work safely when carrying out heavy vehicle transmission and driveline system component removal and replacement activities	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 2.1 select suitable sources of technical information to support heavy 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 component removal and replacement activities	

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out removal and replacement of heavy vehicle transmission and driveline units and components.	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 212 Competence in removing and replacing heavy vehicle transmission and driveline units and components

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 213 Competency in diagnosing and rectifying heavy vehicle transmission and driveline faults

UAN:	**F/601/4929**
Level:	Level 3
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to HV13 Diagnose and Rectify Motor Vehicle Transmission and Driveline Faults
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can 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.

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

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

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

Learning outcome	The learner will:
4. be able to carry out heavy vehicle transmission and driveline diagnosis, rectification and test activities	
Assessment criteria	
The learner can: 4.1 use diagnostic methods that are relevant to the symptoms presented 4.2 evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately 4.3 carry out all diagnostic and rectification activities following: 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 outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 213 Competency in diagnosing and rectifying heavy vehicle transmission and driveline faults

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 221 Competency in overhauling heavy vehicle transmission units

UAN:	**R/601/4921**
Level:	Level 3
Credit value:	6
GLH:	50
Relationship to NOS:	This unit is linked to H11 Overhaul Motor Vehicle Mechanical Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can 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.

Learning outcome	**The learner will:**
1. be able to work safely when overhauling heavy vehicle Transmission units	
Assessment criteria	
The learner can: 1.1 use suitable personal protective equipment and vehicle coverings when overhauling heavy vehicle transmission units	

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

Learning outcome	The learner will:
3. be able to use appropriate tools and equipment	
Assessment criteria	
The learner can: 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 outcome	The learner will:
4. be able to carry out the overhauling of heavy vehicle transmission units	
Assessment criteria	
The learner can: 4.1 carry out all overhauling of heavy vehicle transmission units, adhering to the specifications and tolerances for the vehicle and following: 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. 4.7 complete all system diagnostic activities within the agreed timescales	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 221 Competency in overhauling heavy vehicle transmission units

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 231 Competency in overhauling heavy vehicle steering and suspension units

UAN:	**H/601/4924**
Level:	Level 3
Credit value:	6
GLH:	50
Relationship to NOS:	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

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

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

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

Learning outcome	The learner will:
4. be able to carry out the overhauling of heavy vehicle steering and suspension units	
Assessment criteria	
The learner can: 4.1 carry out all overhauling of heavy vehicle steering and suspension units, adhering to the specifications and tolerances for the vehicle and following: a. the manufacturer's approved overhauling methods b. recognised researched repair methods c. health and safety requirements. d. workplace procedures 4.2 ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul 4.3 inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform 4.4 use testing methods that comply with the manufacturer's requirements. 4.5 adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements. 4.6 ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements. 4.7 complete all system diagnostic activities within the agreed timescales	

Learning outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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	

Unit 231 Competency in overhauling heavy vehicle steering and suspension units

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

Unit 251 Knowledge of conducting routine heavy vehicle maintenance

UAN:	**J/601/4933**
Level:	Level 2
Credit value:	2
GLH:	20
Relationship to NOS:	This unit is linked to HV01 Carry Out Routine Motor Vehicle Maintenance.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of conducting routine maintenance, adjustment and replacement activities as part of the periodic servicing of heavy vehicles.

Learning outcome	**The learner will:**
1. understand how to carry out routine heavy vehicle maintenance	
Assessment criteria	
The learner can: 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 outcome	The learner will:
2. understand the legal requirements applicable to carrying out heavy vehicle maintenance	
Assessment criteria	
The learner can: 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	

Unit 251 Knowledge of conducting routine heavy vehicle maintenance

Supporting information

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

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

Unit 252 Knowledge of heavy vehicle engine mechanical, lubrication and cooling system units and components

UAN:	**D/601/4937**
Level:	Level 2
Credit value:	3
GLH:	20
Relationship to NOS:	This unit is linked to HV02 Remove and replace motor vehicle engine units and components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of 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.

Learning outcome	**The learner will:**
1. understand how the main heavy vehicle engine mechanical systems operate	
Assessment criteria	
The learner can: 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. ompression ratio's b. ylinder capacity c. ower d. orque 1.5 state common terms used in heavy vehicle engine mechanical systems a. tdc	

b. bdc
c. stroke
d. bore

Learning outcome	The learner will:
2. understand how heavy vehicle engine lubrication systems operate	
Assessment criteria	
The learner can: 2.1 identify heavy vehicle engine lubrication system components 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 a. classification of lubricants b. properties of lubricants c. methods of reducing friction 2.5 state common terms used in heavy vehicle engine lubrication system design	

Learning outcome	The learner will:
3. understand how heavy vehicle engine cooling, heating and ventilation systems operate	
Assessment criteria	
The learner can: 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 3.4 identify the key engineering principles that are related to heavy vehicle engine cooling, heating and ventilation systems a. heat transfer b. linear and cubical expansion c. specific heat capacity d. boiling point of liquids 3.5 state common terms used in key heavy vehicle engine cooling, heating and ventilation system design	

Learning outcome	The learner will:
4. understand how to check, replace and test engine mechanical, lubrication and cooling systems system units and components	
Assessment criteria	
The learner can: 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	

Unit 252 Knowledge of heavy vehicle engine mechanical, lubrication and cooling system units and components

Supporting information

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

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
c. Terms used in engine mechanical systems
   i. tdc
   ii. bdc
   iii. stroke
   iv. bore
d. Relative advantages and disadvantages of different engine types and configurations.
e. Engine components and layouts:
   i. side camshaft and overhead camshaft
   ii. single and multi cylinder
   iii. wet and dry liners
   iv. crankshaft dampers
f. Cylinder head layout and design, combustion chamber and piston design.
g. Calculate compression ratios from given data.
h. The procedures used when inspecting engines

i. 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
j. 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, antiwear)
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 importance 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

Unit 253 Knowledge of removing and replacing heavy vehicle electrical units and components

UAN:	**J/601/4947**
Level:	Level 2
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV03 Remove and Replace Motor Vehicle Electrical Auxiliary Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can remove and replace motor vehicle electrical system components. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	**The learner will:**
1. understand heavy vehicle electrical and electronic principles	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
2. understand how heavy vehicle batteries, starting and charging systems operate	
Assessment criteria	
The learner can: 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 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	

Learning outcome	The learner will:
3. understand how heavy vehicle auxiliary electrical systems operate	
Assessment criteria	
The learner can: 3.1 identify heavy vehicle auxiliary system components 3.2 describe the construction and operation of heavy vehicle auxiliary systems 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	

Learning outcome	The learner will:
4. understand how to check, replace and test heavy vehicle electrical systems and components	
Assessment criteria	
The learner can: 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 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	

Unit 253 Knowledge of removing and replacing heavy vehicle electrical units and components

Supporting information

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

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. Auxillary 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

Unit 254 Knowledge of removing and replacing heavy vehicle chassis units and components

UAN:	**L/601/4951**
Level:	Level 2
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV04 Knowledge of heavy vehicle chassis units and components
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

Learning outcome	**The learner will:**
1. understand how heavy vehicle steering systems operate	
Assessment criteria	
The learner can: 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 a. steering angles b. hydraulic forces c. stress and strain 1.5 state common terms used in heavy vehicle steering system design	

Learning outcome	The learner will:
2. understand how heavy vehicle suspension systems operate	
Assessment criteria	
The learner can: 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 2.4 identify the key engineering principles that are related to heavy vehicle suspension systems a. suspension hydraulic damping b. stress and strain 2.5 state common terms used in heavy vehicle suspension system design	

Learning outcome	The learner will:
3. understand how heavy vehicle braking systems operate	
Assessment criteria	
The learner can: 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 identify the key engineering principles that are related to heavy vehicle braking systems a. laws of friction b. hydraulics c. pneumatics d. properties of fluids e. properties of air f. braking efficiency 3.5 state common terms used in heavy vehicle braking system design.	

Learning outcome	The learner will:
4. understand how heavy vehicle wheel and tyre systems operate	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
5. understand the health and safety aspects when working on loaded vehicles	
Assessment criteria	
The learner can: 5.1 identify types of hazards when working on loaded heavy vehicles	

Learning outcome	The learner will:
6. understand how to check, replace and test heavy vehicle chassis units and components	
Assessment criteria	
The learner can: 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 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.	

Unit 254 Knowledge of removing and replacing heavy vehicle chassis units and components

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

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

Chassis layouts

i. types of chassis
ii. axle configurations
iii. rear steered axles
iv. self-steered axles
describe how to remove and replace

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.

g. The principles of electronic power steering systems.

h. The procedures used for inspecting the serviceability and condition of:

i. manual steering
ii. power assisted steering

h.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. rubber suspension
   vi. 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/ damaged linkages

xii. 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 callipers & 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

xvii. air supply and storage
xviii. air control valves
xix. conversion from pneumatic pressure to hydraulic pressure
xx. 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
v. 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:

i. worn shoes or pads
ii. worn or scored brake surfaces
iii. abnormal brake noises
iv. brake judder
v. fluid contamination of brake surfaces
vi. fluid/air leaks
vii. pulling to one side
viii. poor braking efficiency
ix. lack of assistance
x. loss of air pressure
xi. brake drag
xii. brake grab
xiii. brake fade

Endurance Brakes

a. The construction and operation of heavy vehicle endurance 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 three (1S/1M)
   ii. category two (2S/1M)
   iii. category one (2S/2M)
   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

a.
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. light 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
g. Refitting procedures.
h. The inspection and testing of units and systems 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:

Unit 255 Knowledge of inspecting heavy vehicles

UAN:	**Y/601/4967**
Level:	Level 2
Credit value:	4
GLH:	40
Relationship to NOS:	This unit is linked to HV05 Inspect Heavy Vehicles.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of carrying out a range of inspections on heavy vehicles using a variety of equipment and testing methods.

Learning outcome	**The learner will:**
1. understand how to carry out inspections on heavy vehicles using prescribed methods	
Assessment criteria	
The learner can: 1.1 explain the difference between the various prescribed heavy vehicle inspection methods to include: a. pre-delivery and pre-purchase b. pre mot c. daily vehicle checks d. scheduled safety inspection e. pre and post rental inspection 1.2 identify the different systems to be inspected when using the prescribed inspection methods 1.3 identify the procedures involved to carry out the systematic inspection of the prescribed inspection methods on heavy vehicles 1.4 identify conformity of vehicle systems and condition on heavy vehicle inspections 1.5 compare test and inspection results against heavy vehicle specification and legal requirements 1.6 explain how to record and complete the inspection results in the format required 1.7 identify the recommendations that can be made based on results of the heavy vehicle inspections 1.8 explain the implications of failing to carry out heavy vehicle inspection activities correctly	

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

Unit 255 Knowledge of inspecting heavy vehicles

Supporting information

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

Different types of heavy vehicle inspection

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

Vehicle inspections and maintenance records

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

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

The need for vehicle protection prior to carrying out vehicle inspection

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

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

UAN:	**Y/601/4953**
Level:	Level 3
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV07 Diagnose and Rectify Motor Vehicle Engine and Component Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of engine mechanical, electrical, hydraulic and fluid systems.

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

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

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

Supporting information

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

The construction and operation of engine systems

a. 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:
- x types of air flow sensor
- xi fuel supply system
- xii fuel pump
- xiii filter
- xiv fuel regulator
- xv injectors
- xvi main injection
- xvii pre injection
- xviii post injection
- xix electronic control unit (ECU)
- xx injector pulse width
- xxi 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 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

i exhaust emission reduction systems
ii valve mechanisms
iii heating and ventilation
iv cooling
v worn cylinders
vi cylinder liners
vii pistons
viii piston rings
ix crankshaft
x camshaft
xi bearings
xii cylinder head and gasket
xiii valves
xiv valve seats and valve guides
xv camshaft drives
xvi lubrication system and components
xvii oil pump
xviii relief valve
xix filter
xx turbo-charger
xxi 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

i. Rectification or replacement procedures.

j. 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
viunstable idle speed

Faults and symptoms in engine management systems

a. Engine management system failure or malfunctions including:
i misfiring

ii cold or hot starting problems
iii poor performance
iv diesel knock
v exhaust emission levels
vi fuel consumption
vii low power
viii unstable idle speed

Diagnosis of faults in electronic diesel injection and engine management systems

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

vii fault codes

i. Rectification or replacement procedures.

j. Evaluation and the operation of components and systems following diagnosis and repair to confirm system performance.

Faults and symptoms in vehicle comfort systems

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

Diagnosis of faults in vehicle comfort systems

a. Locate and interpret information for:
   - i diagnostic tests
   - ii manufacturer's vehicle and equipment specifications
   - iii use of equipment
   - iv testing procedures
   - v test plans
   - vi fault codes
   - vii legal requirements

b. The preparation of tools and equipment for use in diagnostic testing and assessment.

c. Conduct systematic assessment and testing of comfort systems including:
   - i component condition and performance
   - ii component settings
   - iii component values
   - iv electrical and electronic values
   - v system performance and operation
   - vi drive belts
   - vii controls
   - viii compressors
   - ix condensers
   - x receivers
   - xi dryers
   - xii connections
   - xiii valve
   - xiv hoses
   - xv thermostats and refrigerants
   - xvi sensors
   - xvii speed controls
   - xviii control systems
   - xix servomotors

d. Use of appropriate tools and equipment including:
   - i pressure gauges
   - ii multi-meter
   - iii breakout box
   - iv oscilloscope
   - v diagnostic tester
   - vi manufacturer's dedicated equipment
   - vii flow meter

e. Evaluate and interpret test results from diagnostic testing.
f. Compare test result, values and fault codes with vehicle manufacturer's specifications and settings
g. How to dismantle, components and systems using appropriate equipment and procedures
h. How to assess, examine and measure components including: settings, input and output values, voltages, current consumption, resistance, output patterns with oscilloscope, pressures, condition, wear and performance of components and systems
i. Identification of probable faults and indications of faults, malfunctions, incorrect settings, wear, values, inputs and outputs, fault codes, pressures and leaks
j. Rectification or replacement procedures
k. Evaluation and operation of components and systems following diagnosis and repair to confirm system performance

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

UAN:	**K/601/4956**
Level:	Level 3
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV08 Diagnose and Rectify Motor Vehicle Chassis System Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of braking steering and suspension systems. It also covers advanced heavy vehicle chassis systems and the evaluation of their performance.

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

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

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

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

Supporting information

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

Chassis system operation:

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

Electrical and electronic principles of heavy vehicle chassis systems

a. the operation of electrical and electronic systems and components related to heavy vehicle chassis systems including:
   i ECU
   ii sensors and actuators
   iii electrical inputs
   iv voltages
   v oscilloscope patterns
   vi digital and fibre optic principles

b. the interaction between the electrical/electronic system and mechanical components of chassis systems.
c. electronic and electrical safety procedures.

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

a. layout of:
   - i ABS, EBS, ASR and EBD braking systems
   - ii anti-lock braking
   - iii anti-spin regulation systems
   - iv warning systems

b. operation of:
   - i. pneumatic, hydraulic and electronic control units
   - ii. wheel speed sensors
   - iii. load sensors
   - 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

Unit 261 Knowledge of overhauling heavy vehicle engine mechanical units

UAN:	**M/601/4957**
Level:	Level 3
Credit value:	5
GLH:	42
Relationship to NOS:	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of the construction and operation and overhaul of engines, gearboxes, final drive assemblies, steering and suspension units.

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

Unit 261 Knowledge of overhauling heavy vehicle engine mechanical units

Supporting information

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

How the units and assemblies being overhauled operate

a. Identify unit components
b. Understand unit construction
c. Describe unit operation

How units are dismantled and reassembled

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

Unit and assembly testing and evaluation procedures

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

Faults associated with units and assemblies being overhauled

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

Unit 262 Knowledge of heavy vehicle transmission and driveline units and components

UAN:	**F/601/4963**
Level:	Level 2
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV12 Remove and Replace Commercial Vehicle Transmission Driveline Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of the construction and operation of common manual transmission and driveline systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

Learning outcome	**The learner will:**
1. understand how heavy vehicle clutch systems operate	
Assessment criteria	
The learner can: 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 a. principles of friction b. principle of levers c. torque transmission 1.5 state common terms used in heavy vehicle clutch system design	

Learning outcome	The learner will:
2. understand how heavy vehicle gearbox systems operate	
Assessment criteria	
The learner can: 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 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	

Learning outcome	The learner will:
3. understand how heavy vehicle driveline systems operate	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
4. understand how heavy vehicle gear selection mechanisms operate	
Assessment criteria	
The learner can: 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 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	

Learning outcome	The learner will:
5. understand how to check, replace and test transmission and driveline units and components	
Assessment criteria	
The learner can: 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	

Unit 262 Knowledge of heavy vehicle transmission and driveline units and components

Supporting information

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

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
vi. hydraulic operation

Gearbox systems

a. Construction and operation of gearbox systems including**:**

i. gearshift control systems
ii. manual gearbox
i. automatic gearbox

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 of:
   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

a. The layout and construction of propshafts and drive shafts used in multi-axle drive systems.
c. The reasons for using flexible couplings and sliding joints in transmissions systems.
d. The reason for using constant velocity joints in drive shafts incorporating steering mechanisms.
e. The construction and operation of:
i. universal joints
ii. sliding couplings
iii. constant velocity joints
iv. centre bearings
f. The simple stresses applied to shafts: torsional, bending and shear.
g. 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
h. The reasons for fitting differential/s
i. Calculate final drive gear ratios.
j. 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
bThe 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
- v manual switch (gearstick mounted)
- vi automatic (gearbox mounted)
- vii splitter selection

cThe 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 basic 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

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

UAN:	**L/601/4965**
Level:	Level 3
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to HV13 Diagnose and Rectify Motor Vehicle Transmission and Driveline System Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of heavy vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive units. It also covers the evaluation of performance of the systems.

Learning outcome	**The learner will:**
1. understand how the heavy vehicle transmission and driveline systems operate	
Assessment criteria	
The learner can: 1.1 explain the construction and operation of heavy vehicle transmission and driveline systems 1.2 explain the interaction between electrical, electronic and mechanical components within heavy vehicle transmission and driveline systems 1.3 explain how electrical systems interlink and interact, including multiplexing 1.4 compare heavy vehicle transmission and driveline system components and assemblies against alternatives to identify differences in construction and operation	

1.5	identify the engineering principles that are related to heavy vehicle transmission and driveline systems a. friction b. torque transmission c. materials d. fluids & energy e. potential & kinetic energy

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

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

Supporting information

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

The construction and operation of transmission and driveline systems

a. Including::

i friction clutches
ii fluid couplings
iii multi-speed gearboxes
iv fully automatic - including electronic control
v electronically controlled gearshift systems
vi hub reduction
vii final drive units
viii hubs & shafts

a. Key principles relating to heavy vehicle transmission and driveline systems

i friction
ii torque transmission
iii materials
iv fluids & energy
v 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 toque 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. failure to engage gear
vi. failure to disengage gear
vii. leaks
viii. failure to operate
ix. incorrect shift patterns
x. 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, mullet-meters, 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

i. friction clutches
ii. fluid couplings
iii. multi speed gearboxes
iv. fully automatic - including electronic control
v. electronically controlled gearshift systems

vi. hub reduction
vii. final drive units
viii. hubs & shafts

Measurements and settings

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

Unit 271 Knowledge of overhauling heavy vehicle transmission units

UAN:	**A/601/4959**
Level:	Level 3
Credit value:	4
GLH:	40
Relationship to NOS:	This unit is linked to HV11 Overhaul Motor Vehicle Mechanical Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of the construction and operation and overhaul of engines, gearboxes, final drive assemblies, steering and suspension units.

Learning outcome	**The learner will:**
1. understand how to overhaul heavy vehicle gearbox and final drive units	
Assessment criteria	
The learner can:	
1.1	identify heavy vehicle gearbox and final dive 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

Unit 271 Knowledge of overhauling heavy vehicle transmission units

Supporting information

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

How the units and assemblies being overhauled operate

a. Identify unit components
b. Understand unit construction
c. Describe unit operation

How units are dismantled and reassembled

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

Unit and assembly testing and evaluation procedures

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

Faults associated with units and assemblies being overhauled

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

The procedures for dismantling, removal and replacement of 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.

Refitting procedures.

g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.

h. Inspction and re-instatement of the vehicle following repair to ensure:

i. customer satisfaction

ii. cleanliness of vehicle interior and exterior

iii. security of components and fittings

iv. re-instatement of components and fittings

i. cancelling of any fault codes and warning lights

Unit 272 Knowledge of heavy vehicle fuel, air supply and exhaust system units and components

UAN:	**T/601/4944**
Level:	Level 2
Credit value:	3
GLH:	20
Relationship to NOS:	This unit is linked to HV02.2K Knowledge of Heavy Vehicle Fuel, Air Supply and Exhaust System Units and Components.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit enables the learner to develop an understanding of the construction and operation of common fuel, ignition, air and exhaust systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance

Learning outcome	**The learner will:**
1. understand how heavy vehicle engine fuel systems operate	
Assessment criteria	
The learner can: 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 fuel b. combustion processes c. exhaust gas constituents 1.5 state common terms used in heavy vehicle engine fuel system design	

Learning outcome	The learner will:
2. understand the legal requirements relating to European Emission Standards applicable to commercial vehicles	
Assessment criteria	
The learner can: 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	

Learning outcome	The learner will:
3. understand how heavy vehicle exhaust emission control systems operate	
Assessment criteria	
The learner can: 3.1 identify heavy vehicle exhaust emission control system components 3.2 describe the construction and operation of heavy vehicle exhaust emission control systems 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	

Learning outcome	The learner will:
4. understand how heavy vehicle engine air supply and exhaust systems operate	
Assessment criteria	
The learner can: 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 outcome	The learner will:
5. understand how to check, replace and test engine fuel, air supply and exhaust system units and components	
Assessment criteria	
The learner can: 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 systems and their purposes 5.3 explain how to evaluate the performances of replacement units against vehicle specification 5.4 explain common faults found in heavy vehicle fuel , air supply and exhaust systems and their causes	

Unit 272 Knowledge of heavy vehicle fuel, air supply and exhaust system units and components

Supporting information

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

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
    iii. Regulated pollutants to include:
        i. Hydrocarbons (HC)
        ii. Particulate matter (PM)
        iii. Oxides of Nitrogen (NOx)
        iv. Carbon Monoxide (CO)
i. 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 importance 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

Unit 281 Knowledge of overhauling heavy vehicle steering and suspension units

UAN:	**T/601/4961**
Level:	Level 3
Credit value:	4
GLH:	40
Relationship to NOS:	This unit is linked to HV11.3K Knowledge of Overhauling Heavy Vehicle Steering and Suspension Units.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	This unit allows the learner to demonstrate they can overhaul engines, gearboxes, final drive assemblies, steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

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

Unit 281 Knowledge of overhauling heavy vehicle steering and suspension units

Supporting information

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

How the units and assemblies being overhauled operate

a. Identify unit components
b. Understand unit construction
c. Describe unit operation

How units are dismantled and reassembled

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

Unit and assembly testing and evaluation procedures

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

Faults associated with units and assemblies being overhauled

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

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

a. The preparation, testing and use of:
   i. tools and equipment
   ii. removal and replacement of electrical and electronic systems and components

b. Appropriate safety precautions:
   i. PPE
   ii. vehicle protection when dismantling
   iii. removal and replacing electrical and electronic components and systems

c. The importance of logical and systematic processes.

d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.

e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.

f. Refitting procedures.

g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.

h. Inspection and re-instatement of the vehicle following repair to ensure:
   i. customer satisfaction
   ii. cleanliness of vehicle interior and exterior
   iii. security of components and fittings
   iv. re-instatement of components and fittings
   v. cancelling of any fault codes and warning lights

Unit 406 Competency in diagnosing and rectifying vehicle auxiliary electrical faults

UAN:	**L/601/3749**
Level:	Level 3
Credit value:	10
GLH:	90
Relationship to NOS:	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
Endorsement by a sector or regulatory body:	This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

Learning outcome	**The learner will:**
2. be able to use relevant information to carry out the task	
Assessment criteria	
The learner can: 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.	

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

Learning outcome	The learner will:
4. be able to carry out automotive vehicle auxiliary electrical diagnosis, rectification and test activities	
Assessment criteria	
The learner can: 4.1 use diagnostic methods that are relevant to the symptoms presented 4.2 evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately 4.3 carry out all diagnostic and rectification activities following: 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 outcome	The learner will:
5. be able to record information and make suitable recommendations	
Assessment criteria	
The learner can: 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 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.	

Unit 406 Competency in diagnosing and rectifying vehicle auxiliary electrical faults

Supporting information

Evidence requirements

The Evidence Requirements are shown in full in the Assessment Documentation.

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

UAN:	**A/601/3746**
Level:	Level 3
Credit value:	6
GLH:	45
Relationship to NOS:	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
Endorsement by a sector or regulatory body:	This unit was developed by IMI, the Sector Skills Council for the automotive retail industry.
Aim:	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.

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

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

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

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

Supporting information

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

The electrical principles that are related to light vehicle electrical circuits:
a. Ohms law
b. Voltage
c. Power
d. Current (AC and DC)
e. Resistance
f. Magnetism
g. Electromagnetism and electromagnetic induction
h. Digital and fibre optic principles
i. Electrical units and symbols
j. Electrical and electronic terminology
k. Relevant electrical safety

Battery and Charging
a. The construction and operation of vehicle batteries including:
iii. low maintenance and maintenance free
iv. lead acid and nickel cadmium types
v. cells
vi. separators
vii. plates
viii. electrolyte
b. The operation of the vehicle charging system:
xii. alternator
xiii. rotor
xiv. stator
xv. slip ring
xvi. brush assembly
xvii. three phase output
xviii. diode rectification pack
xix. voltage regulation
xx. phased winding connections
xxi. cooling fan
xxii. 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:

vii. inertia and pre-engaged starter motor

viii. starter ring gear

ix. pinion

x. starter solenoid

xi. ignition/starter switch

xii. starter relay (if appropriate)

xiii. one-way clutch (pre-engaged starter motor)

Lighting systems and technology

a. Lighting systems should include:

i. Xenon lighting

ii. gas discharge lighting

iii. ballast system

iv. LED

v. intelligent front lighting

vi. blue lights

vii. complex reflectors

viii. fibre optic

ix. optical patterning

Lighting circuits and the relationship between each circuit

a. Circuits must include:

i. Sidelights including number plate lights and marker lights

ii. dipped beam

iii. main beam

iv. dim/dip

v. indicators and hazard lights

vi. high intensity and fog light

Common faults and testing methods associated with external lighting system

a. Fault diagnosis for:

i lighting systems failing to operate correctly

ii switches

iii relays

iv bulbs failing to operate.

The operating principles of external lighting systems and multiplexing systems

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

The different types of electric windows and mirror systems and components

a. Components should include:

i window
ii mirror motors
iii multi-functional switches
iv relays
v total closure modules.

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

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

The operating principles of electric windows and mirror systems

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

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

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

The different types of screen heating systems and components

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

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

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

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

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

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

a. Systems and components must include:
   i radio CD and multi play units
   ii DVD players

iii MP3 players
iv speakers
v aerial systems
vi amplifiers
vii V.D.U. screens
viii Satellite Navigation
ix communication units.

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

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

The operating principles of I.C.E. systems

a. Operation of entertainment systems speaker and aerial systems.

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

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

The different types of integrated security/warning systems and components

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

The function of component parts in integrated security and warning systems

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

The operating principles of integrated security and warning systems

a. Operation of alarm systems and audible warning units.

The relevant legislation relevant to security and warning systems

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

Common faults and testing methods associated with security and warning systems

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

The different wiper system components

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

The function of component wiper and washer components

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

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

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

The different heater, cooling system components and air con.

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

vii air conditioning units.

The function of component heater, cooling parts and air conditioning

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

The operating principles of heater, cooling systems and air conditioning

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

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

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

The different types of locking system components

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

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

Appendix 1 Sources of general information

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

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

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

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

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

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

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

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

- **Walled Garden:** how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Useful contacts

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

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

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

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and candidates studying for City & Guilds qualifications may photocopy this document free of charge and/or include a PDF version of it on centre intranets on the following conditions:

- **centre staff may copy the material only for the purpose of teaching candidates working towards a City & Guilds qualification, or for internal administration purposes**
- **candidates may copy the material only for their own use when working towards a City & Guilds qualification**

The *Standard Copying Conditions* (see the City & Guilds website) also apply.

Please note: National Occupational Standards are not © The City and Guilds of London Institute. Please check the conditions upon which they may be copied with the relevant Sector Skills Council.

Published by City & Guilds, a registered charity established to promote education and training

City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)844 543 0000
F +44 (0)20 7294 2413
www.cityandguilds.com