INSTITUTE OF THE MOTOR INDUSTRY

IMI QUALIFICATION

Assessment Criteria

for

IMI Level 3 Diploma in Vehicle Accident Repair Mechanical, Electrical and Trim (MET) Principles

I.D: 500/9681/3

To be used in conjunction with Candidate Assessment Summary, Practical Assessments and Written Assessments

For assessor use only: Teaching Programmes, Assessor Verifier Guidance

01-02-2013 / Version 4

CENTRE INFORMATION

Please be aware that any **legislation** referred to in this qualification may be subject to amendment/s during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of and comply with any amendments, e.g. to health and safety legislation and employment practices.

Please be aware that **vehicle technologies** referred to in this qualification reflect current practice, but may be subject to amendment/s, updates and replacements during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of the latest developments and emerging technologies to ensure the currency of this qualification.

Please note: the relevance of the information contained in the **unit content** will vary depending upon the vehicle types being worked upon. The unit content is for guidance only and is not meant to be prescriptive.

CONTACT SHEET

Learner Name:	
Learner Registration No:	
Learner Address:	
Learner Tel No:	
Learner Email:	
Employer Contact:	
Employer Name & Address:	
Employer Tel No:	

Please complete as appropriate:	
Witness Name:	Witness Name:
Witness Job Title:	Witness Job Title:
Witness Signature:	Witness Signature:
Witness Name:	Witness Name:
Witness Job Title:	Witness Job Title:
Witness Signature:	Witness Signature:
Assessor Name:	Assessor Name:
Assessor Signature:	Assessor Signature:
Assessor Name:	
Assessor Signature:	
Internal Verifier Name:	Internal Verifier Name:
Internal Verifier Signature:	Internal Verifier Signature:

IMI Level 3 Diploma in Accident Repair Vehicle Mechanical, Electrical and Trim (MET) Principles (VRQ)

This qualification consists of 6 Mandatory Units and 7 Mandatory Specialist Units.

All units are either Knowledge (K) or Skills (S) Units. The K or S units are combined to form a topic 'set'

In order to pass the qualification, learners must achieve a minimum of 44 credits from the following groups:

Group A: 29 credits from the 6 Mandatory Units.

Group B: 15 credits from the Mandatory Specialist Units

A minimum of 23 credits must be achieved at Level 3 or above.

Please note that every knowledge unit has an online test and the test number is the same as the 'set ref'

Group A: Mandatory Units

Set Ref:	Unit Ref, Unit Title & I.D. Number	GLH	Unit Level	Credit Value
G0102	G0102K – Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment (D/601/6171)	30	2	3
	G0102S – Skills in Health, Safety and Good Housekeeping in the Automotive Environment (Y/601/7254)	60	2	7
G3	G3K – Knowledge of Support for Job Roles in the Automotive Environment (T/601/6175)	20	3	3
	G3S – Skills in Supporting Job Roles in the Automotive Environment (J/601/6262)	40	3	5
G4	G4K – Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment (K/601/6237)	40	2	4
	G4S – Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment (Y/601/6279)	60	2	7

GROUP B: Mandatory Specialist Units

Set Ref:	Unit Ref, Unit Title & I.D Number	GLH	Unit Level	Credit Value
MET04	MET04K – Knowledge of Removing and Fitting Vehicle Electronically Controlled Vehicle Mechanical Components (D/601/6039)	20	3	2
	MET04S – Skills in Removing and Fitting Vehicle Electronically Controlled Vehicle Mechanical Components (L/601/6070)	20	3	2
MET05	MET05K – Knowledge of Removing and Fitting Vehicle Electronic Components and Systems (D/601/6042)	20	3	3
	MET05S – Skills in Removing and Fitting Vehicle Electronic Components and Systems (T/601/6113)	20	3	2
MET06	MET06K – Knowledge of Removing, Refurbishing and Fitting Trim Components (K/601/6044)	20	3	2
	MET06S – Skills in Removing, Refurbishing and Fitting Trim Components (F/601/6115)	20	3	2
AC1	AC1 – Refrigerant Handling (EC 842-2006) (K/600/3391)	20	3	2

UNIT REF: G0102K	UNIT TITLE: KNOWLEDGE OF HEALTH, SAFETY AND GOOD HOUSEKEEPING IN THE AUTOMOTIVE ENVIRONMENT

Level: 2	Route: Knowledge	Credit Value: 3	GLH: 60
Mapping: This unit is mapped to the IMI NOS G1 and G2			
Rationale: This unit enables the learner to develop an understanding of routine maintenance and cleaning of the automotive environment and using resources economically and 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 OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand the correct personal and vehicle protective equipment to be used within the automotive environment	1.1. Explain the importance of wearing the types of PPE required for a range automotive repair activities 1.2. Identify vehicle protective equipment for a range of repair activities 1.3. Describe vehicle and personal safety considerations when working at the roadside
2. Understand effective housekeeping practices in the automotive environment	2.1. Describe why the automotive environment should be properly cleaned and maintained. 2.2. Describe requirements and systems which may be put in place to ensure a clean automotive environment. 2.3. Describe how to minimise waste when using utilities and consumables 2.4. State the procedures and precautions necessary when cleaning and maintaining an automotive environment. 2.5. Describe the selection and use of cleaning equipment when dealing with general cleaning, spillages and leaks in the automotive environment. 2.6. Describe procedures for correct disposal of waste materials from an automotive environment 2.7. Describe procedures for starting and ending the working day which ensure effective housekeeping practices are followed

3. Understand key health and safety requirements relevant to the automotive environment	3.1. List the main legislation relating to automotive environment health and safety. 3.2. Describe the general legal duties of employers and employees required by current health and safety legislation 3.3. Describe key, current health and safety requirements relating to the automotive environment. 3.4. Describe why workplace policies and procedures relating to health and safety are important
4. Understand about hazards and potential risks relevant to the automotive environment	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.
5. Understand personal responsibilities	5.1. Explain the importance of personal conduct in maintaining the health and safety of the individual and others 5.2. Explain the importance of personal presentation in maintaining health safety and welfare

Content:

Economic use of Resources
a. Consumable materials e.g. grease, oils, split pins, locking and fastening devices etc.

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

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

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

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

Content: Contd

General regulations to include an awareness of:

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

Legislative duties

a. The purpose of a Health and Safety Policy.
b. The relevance of the Health and Safety Executive.
c. The relevance of an initial induction to Health and Safety requirements at your workplace.
d. General employee responsibilities under the HASAWA and the consequences of non-compliance.
e. General employer responsibilities under the HASAWA and the consequences of non-compliance.
f. The limits of authority with regard to Health and Safety within a personal job role.
g. Workplace procedure to be followed to report Health and Safety matters.

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

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

Content: Contd

PPE to include:

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

Fire and extinguishers

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

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

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

Content: Contd

Product warning labels to include:

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

Warning signs and notices

a. Colours used for warning signs:
   i. red
   ii. blue
   iii. green
b Shapes and meaning of warning signs:
   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 personal, customers, contractors etc entering your 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 are outside your 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 policies and procedures on:
   i. the use of safe working methods and equipment
   ii. the safe use of hazardous substances
   iii. smoking, eating , drinking and drugs
   iv. emergency procedures
   v. personal appearance
b. The importance of personal appearance in the control of health and safety

Content: Contd

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 REF: G0102S	UNIT TITLE: SKILLS IN HEALTH, SAFETY AND GOOD HOUSEKEEPING IN THE AUTOMOTIVE ENVIRONMENT

Level: L2	Route: Skills	Credit Value: 7	GLH: 60
Mapping: This unit is mapped to the IMI NOS G1 and G2			
Rationale: This unit will enable the learner to develop the skills required to carry out day to day work area cleaning, clearing away, dealing with spillages and disposal of waste, used materials and debris. Identify hazards and risks in the automotive environment and complying with relevant legislation and good practice and work safely at all times within the automotive environment, both as an individual and with others.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to use correct personal and vehicle protection within the automotive environment	1.1. Select and use personal protective equipment throughout activities. To include appropriate protection of: a eyes b ears c head d skin e feet f hands g lungs 1.2.. Select and use vehicle protective equipment throughout all activities
2. Be able to carry out effective housekeeping practices in the automotive environment	2.1. Select and use cleaning equipment which is of the right type and suitable for the task 2.2. Use utilities and appropriate consumables, avoiding waste 2.3. Use materials and equipment to carry out cleaning and maintenance duties in allocated work areas, following automotive work environment policies, schedules and 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

3. Be able to recognise and deal with dangers in order to work safely within the automotive workplace	3.1. Name and locate the responsible persons for health and safety in their relevant workplace 3.2. Identify and report working practices and hazards which could be harmful to themselves or others 3.3. Carry out safe working practices whilst working with equipment, materials and products in the automotive environment 3.4. Rectify health and safety risks encountered at work, within the scope and capability of their job role
4. Be able to conduct themselves responsibly	4.1. Show personal conduct in the workplace which does not endanger the health and safety of themselves or others 4.2. Display suitable personal presentation at work which ensures the health and safety of themselves and others at work

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** produce evidence of use of personal and vehicle protection, cleaning the work environment and disposal of waste on **2** separate **occasions.**
2. **You must** produce evidence of identifying risks which may result from at least **2** of the items listed below:
• the use and maintenance of machinery or equipment
• the use of materials or substances
• working practices which do not conform to laid down policies
• unsafe behaviour
• accidental breakages and spillages
• environmental factors
3. **You must** produce evidence of identifying risks.
4. **You must** produce evidence of following at least **2** of the workplace policies listed below:
• the use of safe working methods and equipment
• the safe use of hazardous substances
• smoking, eating, drinking and drugs
• what to do in the event of an emergency
• personal presentation

UNIT REF: G3K	UNIT TITLE: KNOWLEDGE OF SUPPORT FOR JOB ROLES IN THE AUTOMOTIVE WORK ENVIRONMENT

Level: 3	Route: Knowledge	Credit Value: 3	GLH: 20
Mapping: This unit is mapped to the IMI NOS G3			
Rationale: 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 OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand key organisational structures, functions and roles within the automotive work environment	1.1. Identify the purpose of different sections of a typical automotive work environment 1.2. Explain organisational structures and lines of communication within the automotive work environment 1.3. Explain levels of responsibility within specific job roles in automotive workplace. To include: a. trainee b. skilled technician c. supervisor d. manager
2. Understand the importance of obtaining, interpreting and using information in order to support their job role within the automotive work environment	2.1. Explain the importance of different sources of information in a automotive work environment. 2.2. Explain how to find, interpret and use relevant sources of information 2.4. Describe the main legal requirements relating to the vehicle, including road safety requirements 2.5. Explain the importance of working to recognised procedures and processes 2.6. Explain when replacement units and components must meet the manufacturers' original equipment specification. 2.7. Explain the purpose of how to use identification codes
3. Understand the importance of different types of communication within the automotive work environment	3.1. Explain where different methods of communication would be used within the automotive environment 3.2. Explain the factors which can determine your choice of communication. 3.3. Explain how the communication of information can change with the target audience to include uninformed and informed people

4. Understand communication requirements when carrying out vehicle repairs in the automotive work environment	4.1. Explain how to report using written and verbal communication. 4.2. Explain the importance of documenting information relating to work carried out in the automotive environment 4.3. Explain the importance of working to agreed timescales
5. Understand how to develop good working relationships with colleagues and customers in the automotive workplace	5.1. Describe how to develop positive working relationships with colleagues and customers 5.2. Explain the importance of developing positive working relationships 5.3. Explain the importance of accepting otherpeoples' views and opinions. 5.4. Explain the importance of making and honouring realistic commitments to colleagues and customers.

Content:

The structure of a typical vehicle repair business

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

b. Sources of information
   i. other staff
   ii. manuals
   iii. parts lists
   iv. computer software and the internet
   v. manufacturer
   vi. diagnostic equipment

Communication requirements when carrying out vehicle repairs

a. Locating and using correct documentation and information for:
   i. recording vehicle maintenance and repairs
   ii. vehicle specifications
   iii. component specifications
   iv. oil and fluid specifications
   v. equipment and tools
   vi. identification codes

b. Procedures for:
   i. referral of problems
   ii. reporting delays
   iii. additional work identified during repair or maintenance
   iv. keeping others informed of progress

Content: Contd

Methods of Communication

a. Verbal
b. Signs and notices
c. Memos
d. Telephone
e. Electronic mail
f. Vehicle job card
g. Notice boards
h. SMS text messaging
i. Letters

Organisational & Customer requirements:

a Importance of time scales to customer and organisation
b Relationship between time and costs
c Meaning of profit

Choice of Communication

a. Distance
b. Location
c. Job responsibility

Importance of maintaining positive working relationships:

a Morale
b Productivity
c Company image
d Customer relationships
e Colleagues

UNIT REF: G3S	UNIT TITLE: SKILLS IN SUPPORTING JOB ROLES IN THE AUTOMOTIVE WORK ENVIRONMENT

Level: 3	Route: Skills	Credit Value: 5	GLH: 40
Mapping: This unit is mapped to the IMI NOS G3			
Rationale: This unit will help the learner develop the skills required to keep good working relationships with all colleagues and customers in the automotive work environment by using effective communication and support.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to work effectively within the organisational structure of the automotive work environment	1.1. Respond promptly and willingly to requests for assistance from customers and colleagues 1.2. Refer customers and colleagues to the correct person should requests fall outside their responsibility and capability
2. Be able to obtain and use information in order to support their job role within the automotive work environment	2.1. Select and use legal and technical information, in an automotive work environment
3. Be able to communicate with and support colleagues and customers effectively within the automotive work environment	3.1. Use methods of communication with customers and colleagues which meet their needs 3.2. Give customers and colleagues accurate information 3.3. Make requests for assistance from or to customers and colleagues clearly and courteously
4. Be able to develop and keep good working relationships in the automotive work environment	4.1. Contribute to team work by initiating ideas and co-operating with customers and colleagues 4.2. Treat customers and colleagues in a way which shows respect for their views and opinions 4.3. Make and keep achievable commitments to customers and colleagues 4.4. Inform colleagues promptly of anything likely to affect their own work

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** produce witness testimony from your peers **and** supervisor **or** tutor that you have worked well with others.
2. **You must** produce evidence carrying out the above whilst performing your normal duties.

UNIT REF: G4K	UNIT TITLE: KNOWLEDGE OF MATERIALS, FABRICATION, TOOLS AND MEASURING DEVICES USED IN THE AUTOMOTIVE ENVIRONMENT

Level: 2	Route: Knowledge	Credit Value: 4	GLH: 40
Mapping: This unit is mapped to the IMI NOS G4			
Rationale: 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 and the correct application of automotive engineering fabrication and fitting principles			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand how to select, use and care for hand tools and measuring devices in the automotive environment	1.1. Identify and explain the use of common types of hand tools used for fabricating and fitting in the automotive environment 1.2. Identify and explain the use of common measuring devices used for fabrication and fitting in the automotive environment 1.3. Describe, within the scope of their responsibilities, how to select, prepare and maintain hand tools, measuring devices and PPE used for fabrication, repair and fitting in the automotive environment 1.4. State the limitations of common hand tools and measuring devices used for fabricating, repair and fitting in the automotive workplace 1.5. Explain how common hand tools and measuring devices used for fabricating, repair and fitting in the automotive environment should be stored and maintained 1.6. Identify common electrical measuring tools used in the repair of vehicles and components 1.7. Explain the preparation and safe and correct use of common electrical tools when measuring voltage, current and resistance
2. Understand how to prepare and use common workshop equipment	2.1. Describe the preparation and safe use of workshop equipment 2.2. Explain the term: safe working load

3. Understand how to select materials when fabricating, modifying and repairing vehicles and fitting components	3.1. Describe the properties, application and limitations of ferrous and non-ferrous metals, including their safe use. 3.2. Describe the properties, application and limitations of common non-metallic materials, including their safe use 3.3. Define common terms relating to the properties of materials
4. Understand how to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	4.1. Describe how to tap threads, file, cut and drill plastics and metals when modifying or repairing vehicles 4.2. Describe how to measure, mark out, shape and join materials when fabricating 4.3. Describe the selection and fitting procedures of the following: a. gaskets and seals b. sealants and adhesives c. fittings and fasteners d. electrical circuit components 4.4. Identify locking, fastening and fixing devices 4.5. State the importance of correct operating specifications for limits, fits and tolerances in the automotive environment

UNIT REF: G4S	UNIT TITLE: SKILLS IN MATERIALS, FABRICATION, TOOLS AND MEASURING DEVICES IN THE AUTOMOTIVE ENVIRONMENT

Level: 2	Route: Skills	Credit Value: 7	GLH: 60
Mapping: This unit is mapped to the IMI NOS G4			
Rationale: 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 and the correct application of automotive engineering fabrication and fitting principle			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to select, maintain and use and hand tools and measuring devices in the automotive environment	1.1. Select, maintain and use suitable hand tools safely when fabricating and fitting in the automotive workplace 1.2. Select, maintain and use suitable measuring devices safely when fabricating and fitting in the automotive environment 1.3. Select, maintain and use suitable PPE for fabrication, repair and fitting in the automotive environment. 1.4. Select, maintain and use suitable electrical measuring tools safely when repairing vehicles and components
2. Be able to prepare and use common workshop equipment	2.1. Use suitably maintained workshop equipment safely 2.2. Use correct interpretation of 'safe working load' on lifting and supporting equipment. 2.3. Report any faulty or damaged tools and equipment to the relevant persons clearly and promptly. 2.4. Store work tools and equipment in a safe manner which permits ease of access and identification for use.
3. Be able to select materials when fabricating, modifying and repairing vehicles and fitting components	3.1. Select and use appropriate materials whilst constructing, fitting, modifying or repairing vehicles and components.

4. Be able to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components	4.1. Use correct procedures when: a. filing, b. tapping threads c. cutting plastics and metals d. drilling plastics and metals. e. fitting 4.2. Use appropriate techniques when fabricating, repairing and modifying vehicles and components 4.3. Select and use: a. gaskets b. seals c. sealants d. fittings and fasteners 4.4. Apply modification and repair techniques to automotive electrical circuits 4.5. Select and use locking, fixing and fastening devices

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** produce evidence of undertaking basic routine checks of hand tools, measuring devices and workshop equipment covering all of those listed below:
• electrical
• mechanical
• pneumatic
• hydraulic
2. **You must** produce evidence of fabricating **at least 1 item** from suitable materials to known tolerances, which includes the following processes
• filing
• tapping threads
• cutting
• drilling
• joining
3. **You must** be observed by your assessor carrying out routine checks and during stages of fabrication

UNIT REF: MET04K	UNIT TITLE: KNOWLEDGE OF REMOVING AND FITTING ELECTRONICALLY CONTROLLED VEHICLE MECHANICAL COMPONENTS

Level: 3	Route: Knowledge	Credit Value: 2	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET04			
Rationale: This unit enables the learner to develop knowledge in order to carry out the removal and fitting of a range of complex mechanical vehicle components. It also covers functional testing of fitted components and identification of additional unscheduled work.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand how to carry out the removal and fitting of electronically controlled mechanical vehicle components	1.1. Explain the procedures involved prior to carrying out the systematic removal and fitting of electronically controlled mechanical vehicle components to the standard required 1.2. Explain the procedures involved in carrying out the systematic removal and fitting of electronically controlled mechanical vehicle components to the standard required 1.3. Explain the methods and procedures for storing removed electronically controlled mechanical vehicle components 1.4. Explain the reasons for the different types of fastenings and fixings used when removing and fitting complex mechanical vehicle components 1.5. Explain the procedures involved to reinstate the system to manufacturers specification 1.6. Explain correct conformity of vehicle systems against vehicle specification and legal requirements on completion 1.7. Explain the procedure for identifying, evaluating, recording and reporting damage to vehicle components and units
2. Understand how the electronically controlled mechanical vehicle systems operate	2.1. Identify complex mechanical vehicle system components 2.2. Explain the construction and operation of complex mechanical vehicle systems 2.3. Explain how components and systems interact with other vehicle systems

Content:

The construction and operating principals of electronically controlled suspension systems and assemblies

Suspension

a. The components and layout of electronically controlled suspension systems
b. The operation of electronically suspension systems and components:
c. The advantages of different systems including:
    i. non-independent
    ii. independent suspension (IFS)
    iii. independent suspension (IRS)
    iv. hydraulic
    v. hydro-pneumatic
    vi. rigid axle
d The principles of electronic suspensions systems.
e The forces acting on suspension systems during braking, driving and cornering.
f The methods of locating the road wheels against braking, driving and cornering forces.
g The methods of controlling cornering forces by fitting anti-roll torsion members
h Suspension terms:
    i. rebound
    ii. bump
    iii. float
    iv. dive
    v. pitch
    vi. roll
    vii. compliance
i. The procedures used for inspecting the serviceability and condition of the suspension system

Components and operation of self-levelling suspension

a. The components, construction and operation of a self leveling suspension system.
b. The operation of self -leveling suspension system under various conditions:
    i. self-energising
    ii. pump operated self-levelling suspension

Operation of fitting ride-controlled systems.

a. The reasons for fitting ride controlled systems.
b. The operation of driver controlled and ride controlled systems.

The construction and operating principals of climate control systems and assemblies

The function of component heater, cooling parts and climate control

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 climate control

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

Content: contd

General

The procedures for dismantling, removal and replacement of suspension/climate control 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 suspension/climate control systems and components
b. Appropriate safety precautions:
   i. PPE
   ii. vehicle protection when dismantling
   iii. removing and replacing suspension/climate control systems and components
c. The important of logical and systematic processes.
d. The inspection and testing of suspension/climate control systems and components.
e. The preparation of replacement units for re-fitting or replacement of suspension/climate control 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

Procedures to prevent damage to the vehicle, components and contents when removing, storing and refitting components

a. The methods that can be used to protect undamaged items to ensure they are removed and refitted without causing unnecessary damage:
b. The procedures for the correct storage of vehicle contents.
c. The process for identifying, evaluating and reporting of extra damage and items that may have broken when removed, refitted or unscheduled work

Types of clips and fixings

a. The following types of clips and identify reasons and limitations for their use:
   i. speed
   ii. 'c'
   iii. 'd'
   iv. 'j' type captive nut
   v. 'r'
   vi. 'u' type captive nut
   vii. cable clip
   viii. trim clips
b. The following types of fixings and identify reasons and limitations for their use:
   i. pop rivet
   ii. plastic rivet
   iii. plastic capture nut
   iv. nut and bolt
   v. shoulder bolt
   vi. 'Nyloc' type nuts
   vii. washers
   viii. 'Spring' type washers
   ix. self tapping screws and bolts
   x. quick release plastic trim fastenings
   xi. trim tapes
   xii. adhesives and sealers

Content: contd

The processes involved when carrying out quality checks

a. Items that may have been 'workshop' soiled and describe processes for rectifying:
    i. door cards
    ii. seats
    iii. carpets
    iv. boot and bonnet trims
b. Methods for checking gaps.

Mechanical Components

a. Suspension - Active Suspension
b. Climate Control

UNIT REF: MET04S	UNIT TITLE: SKILLS IN REMOVING AND FITTING ELECTRONICALLY CONTROLLED VEHICLE MECHANICAL COMPONENTS

Level: 3	Route: Skills	Credit Value: 2	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET04			
Rationale: This unit will help the learner to develop skills in order to carry out the removal and fitting of a range of electronically controlled mechanical vehicle components. It also covers the procedures used when fitting components.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to work safely when carrying out the removal and fitting of electronically controlled mechanical vehicle components	1.1 Wear suitable personal protective equipment and use suitable vehicle coverings throughout all motor vehicle removal and fitting electronically controlled mechanical vehicle components 1.2. Work in a way which minimises the risk of damage or injury to the vehicle, people and the environment
2. Be able to use relevant information to carry out the task	2.1. Select suitable sources of technical information to support vehicle removal and fitting activities including: a vehicle technical data b removal and fitting procedures c legal requirements 2.2. Use technical information to support vehicle removal and fitting activities including:
3. Be able to use appropriate tools and equipment	3.1. Select the appropriate tools and equipment necessary for carrying out the removal and fitting of complex mechanical components 3.2. Ensure that equipment has been calibrated and is in a safe working condition to meet manufacturers' and legal requirements 3.3 Use the correct tools and equipment in the way specified by manufacturers when carrying out removal and fitting of complex mechanical components
4. Be able to carry out removal and fitting of electronically controlled mechanical vehicle components	4.1. Remove and refit electronically controlled mechanical vehicle components 4.2. Remove and refit the electronically controlled mechanical vehicle components adhering to the correct specifications and tolerances for the vehicle and following: a. the manufacturer's approved removal and fitting methods b. recognised researched removal and fitting methods 4.3 Ensure that the removal and fitting of the electronically controlled mechanical vehicle components conforms to the vehicle operating specification and any legal requirements 4.4 Ensure no damage occurs to other components when removing and fitting the electronically controlled mechanical vehicle components 4.5 Ensure all components are stored safely and in the correct location

5. Be able to record information and make suitable recommendations	5.1. Produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2. Make suitable and justifiable recommendations for cost effective repairs 5.3. Record and report any additional faults noticed during the course of their work promptly in the format required

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** remove and replace **at least 1** unit or component **from 1 of the 4 systems listed below**.
suspension – active suspension
climate control
ABS braking components
transmission

UNIT REF: MET05K	UNIT TITLE: KNOWLEDGE OF REMOVING AND FITTING VEHICLE ELECTRONIC COMPONENTS AND SYSTEMS

Level: 3	Route: Knowledge	Credit Value: 3	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET05			
Rationale: This unit enables the learner to develop knowledge in order to carry out the removal and fitting of a range of vehicle electronics. It also covers functional testing of fitted components and identification of additional unscheduled work.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand how to carry out the removal and fitting vehicle electronics	1.1. Explain the procedures involved in carry out the systematic removal and fitting of vehicle electronic system components 1.2. Explain the methods and procedures for storing removed vehicle electronic components 1.3. Explain the quality checks that can be used to ensure correct alignment and operation of electronic components to manufacturers specification 1.4. Explain correct conformity of vehicle systems against vehicle specification and legal requirements on completion 1.5. Explain the procedure for identifying, evaluating and reporting damage to vehicle electronics and units
2. Understand how vehicle electronic systems operate	2.1. Identify vehicle electronic systems 2.2. Explain the construction and operation of vehicle electronic systems 2.3. Explain how components and systems interact with other vehicle systems

Content:

The different types of In Car Entertainment (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

Content: contd

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

The different 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

The function of components in lighting systems

b. 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

The operating principles of lighting systems

a. Operation of lighting 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 explain how components and systems interact with other vehicle systems

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. diodes
   viii. horns

Content: contd

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

The operation and removal of the dash panel and auxiliary fittings

a. Operation and removal of the dash panel and auxiliary fittings

Procedures to prevent damage to the vehicle, components and contents when removing, storing and refitting components

a. The methods that can be used to protect undamaged items to ensure they are removed and refitted without causing unnecessary damage:
b. The procedures for the correct storage of vehicle contents.
c. The process for identifying, evaluating and reporting extra damage and items that may have broken when removed, refitted or unscheduled work

Types of clips and fixings

a. The following types of clips and identify reasons and limitations for their use:
    i. speed
    ii. 'c'
    iii. 'd'
    iv. 'j' type captive nut
    v. 'r'
    vi. 'u' type captive nut
    vii. cable clip
    viii. trim clips
b. The following types of fixings and identify reasons and limitations for their use:
    i. pop rivet
    ii. plastic rivet
    iii. plastic capture nut
    iv. nut and bolt
    v. shoulder bolt
    vi. 'Nyloc' type nuts
    vii. washers
    viii. 'Spring' type washers
    ix. self tapping screws and bolts
    x. quick release plastic trim fastenings
    xi. trim tapes
    xii. adhesives and sealers

The processes involved when carrying out quality checks

a. Items that may have been 'workshop' soiled and describe processes for rectifying:
    i. door cards
    ii. seats
    iii. carpets
    iv. boot and bonnet trims
b. Methods for checking gaps.
c. The process for checking and aligning headlamps:
    i. address handling procedures for halogen bulbs
    ii. address handling and health and safety issues relating to xenon bulbs and systems

Vehicle Electronic Components

a. In Vehicle Entertainment – Audio & Visual
b. Lighting – High Voltage Electronic/Electrical Directional Control
c. Security Systems
d. Dash Panel and Auxiliary Fittings

UNIT REF: MET05S	UNIT TITLE: SKILLS IN REMOVING AND FITTING VEHICLE ELECTRONIC COMPONENTS AND SYSTEMS

Level: 3	Route: Skills	Credit Value: 2	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET05			
Rationale: This unit will help the learner to develop skills in order to carry out the removal and fitting of a range of vehicle electronics. It also covers functional testing of fitted components.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to work safely when carrying out the removal and fitting of **Vehicle Electronics**	1.1. Wear suitable personal protective equipment and use suitable vehicle coverings throughout all motor vehicle removal and fitting of vehicle electronics 1.2. Work in a way which minimises the risk of damage or injury to the vehicle, people and the environment
2. Be able to use relevant information to carry out the task	2.1. Select suitable sources of technical information to support vehicle removal and fitting activities including: a. vehicle technical data b. removal and fitting procedures c. legal requirements 2.2. Use technical information to support vehicle removal and fitting activities
3. Be able to use appropriate tools and equipment	3.1. Select the appropriate tools and equipment necessary for carrying out the removal and fitting of vehicle electrical components 3.2. Ensure that equipment has been calibrated and is in a safe working condition 3.3 Use the correct tools and equipment in the way specified by manufacturers when carrying out removal and fitting of vehicle electrical components
4. Be able to carry out removal and fitting of vehicle electronics	4.1. Remove and refit vehicle electronics 4.2. Remove and refit vehicle electronics adhering to the correct specifications and tolerances for the vehicle and following: a. the manufacturer's approved removal and fitting methods b. recognised researched removal and fitting methods 4.3. Ensure that the removal and fitting of vehicle electronics conforms to the vehicle operating specification and any legal requirements 4.4. Ensure no damage occurs to other components when removing and fitting the vehicle electronics 4.5. Ensure all components are stored safely and in the correct location

5. Be able to record information and make suitable recommendations	5.1. Produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2. Make suitable and justifiable recommendations for cost effective repairs 5.3. Record and report any additional faults noticed during the course of their work promptly in the format required

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** remove and replace at least **1 different key** unit or component, from **2** of the **4** systems listed below.
in vehicle entertainment – audio and visual
lighting – high voltage electronic/electrical directional control
security systems
dash panel and auxiliary fittings

UNIT REF: MET06K	UNIT TITLE: KNOWLEDGE OF REMOVING, REFURBISHING AND FITTING TRIM COMPONENTS

Level: 3	Route: Knowledge	Credit Value: 2	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET06			
Rationale: This unit enables the learner to develop knowledge in order to carry out the removal, refurbishment and fitting of a range of trim components. It also covers functional testing of fitted components and identification of additional unscheduled work.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Understand how to carry out the removal, refurbishment and fitting of trim components	1.1. Explain the procedures involved in carry out the systematic removal, refurbishment and fitting of trim components 1.2. Explain the methods and procedures for storing removed trim and vehicle components 1.3. Explain the procedures, methods and reasons for ensuring correct alignment of vehicle components 1.4. Explain the quality checks that can be used to ensure correct alignment and operation of components to manufacturers specification 1.5. Explain correct conformity of vehicle systems against vehicle specification and legal requirements on completion 1.6. Explain the procedure for identifying, evaluating, recording and reporting damage to vehicle components and units
3. Understand the construction of trim components and refurbishing methods	2.1. Identify the trim system components that may be refurbished 2.2. Explain the construction and refurbishing methods used for trim components and systems

Content:

The procedures relating to the removal, refurbishment and fitting of vehicle trim and fitment

a. How to remove and reinstate trim and fitments.
   i. seating systems
   ii. convertible roofs
b. The tools and procedure for removing seat coverings.
c. The tools consumables and procedure for reinstating seat coverings.
d. The tools consumables and procedure for removing and reinstating convertible roof systems.

The procedures to prevent damage to the vehicle, components and contents when removing, storing and fitting components

a. The methods that can be used to protect undamaged items to ensure they are removed and refitted without causing unnecessary damage.
b. The procedures for the correct storage of vehicle contents.
c. The process for identifying, evaluating and reporting of extra damage and items that may have broken when removed refitted or are unscheduled work.

Content: contd

Types of clips and fixings

a. The following types of clips and identify reasons and limitations for their use:
    i. speed
    ii. 'c'
    iii. 'd'
    iv. 'j' type captive nut
    v. 'r'
    vi. 'u' type captive nut
    vii. cable clip
    viii. trim clips
b. The following types of fixings and identify reasons and limitations for their use:
    i. pop rivet
    ii. plastic rivet
    iii. plastic capture nut
    iv. nut and bolt
    v. shoulder bolt
    vi. 'Nyloc' type nuts
    vii. washers
    viii. 'Spring' type washers
    ix. self tapping screws and bolts
    x. quick release plastic trim fastenings
    xi. trim tapes
    xii. adhesives and sealers

The processes involved when carrying out quality checks

a. Items that may have been 'workshop' soiled and describe processes for rectifying:
    i. door cards
    ii. seats
    iii. carpets
    iv. boot and bonnet trims
b. Methods for checking gaps.

Trim Components

a. Seat Recovering
b. Convertible Roofs

UNIT REF: MET06S	UNIT TITLE: SKILLS IN REMOVING, REFURBISHING AND FITTING TRIM COMPONENTS

Level:	Route: Skills	Credit Value: 2	GLH: 20
Mapping: This unit is mapped to the IMI NOS MET06			
Rationale: This unit will help the learner to develop knowledge to carry out the removal, refurbishment and fitting of a range of trim components. It also covers functional testing of fitted components.			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to work safely when carrying out the removal, refurbishment and fitting of trim components	1.1. Wear suitable personal protective equipment and use suitable vehicle coverings throughout all motor vehicle removal, refurbishment and fitting of trim components 1.2. Work in a way which minimises the risk of damage or injury to the vehicle, people and the environment
2. Be able to use relevant information to carry out the task	2.1. Select suitable sources of technical information to support vehicle removal and refurbishment activities including: a. vehicle technical data b. removal and refurbishment procedures c. legal requirements 2.2. Use technical information to support vehicle removal and refurbishment activities
3. Be able to use appropriate tools and equipment	3.1. Select the appropriate tools and equipment necessary for carrying out the removal, refurbishment and fitting of trim components 3.2. Ensure that equipment has been calibrated and is in a safe working condition to meet manufacturers' and legal requirements 3.3 Use the correct tools and equipment in the way specified by manufacturers when carrying out removal, refurbishment and fitting of trim components
3. Be able to carry out removal, refurbishment and fitting of trim components	4.1. Remove, refurbish and fit trim components 4.2. Remove, refurbish and fit trim components adhering to the correct specifications and tolerances for the vehicle and following: a. the manufacturer's approved removal and refurbishment methods b. recognised researched removal and refurbishment methods 4.3. Ensure that the removal, refurbishment and fitting of trim components conforms to the vehicle operating specification and any legal requirements 4.4. Ensure no damage occurs to other components when removing, refurbishing and fitting trim components 4.5. Ensure all components are stored safely and in the correct location

5. Be able to record information and make suitable recommendations	5.1. Produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2. Make suitable and justifiable recommendations for cost effective repairs 5.3. Record and report any additional faults noticed during the course of their work promptly in the format required

SPECIFIC PERFORMANCE REQUIREMENTS

1. **You must** refurbish **at least 1** key trim unit or component covering the learning outcomes.

UNIT REF: AC01	UNIT TITLE: REFRIGERANT HANDLING (EC 842-2006)

Level: 3	Route: Air Conditioning and Climate Control
Credit Value: 2	GLH: 20

Rationale: After July 2010 all individuals working on Mobile Air Conditioning (MAC) systems (for cars and car derived vans) must have achieved, as a minimum requirement, a refrigerant handling qualification which meets Mobile Air Conditioning (MAC) Commission Regulation EC 842/2006 and the later Annex to Commission Regulation EC 307/2008. This unit meets those requirements, thereby enabling individuals to work on these systems after this date.

LEARNING OUTCOMES

The Learner will:

1. Know about the operation of A/C systems in motor vehicles
2. Know about the use and properties of the fluorinated greenhouse gases used as refrigerants in A/C systems in motor vehicles and the impact of the emissions of these gases on the environment (order of magnitude of their global warming potential in relation to climate change)
3. Understand the relevant provisions of regulation (EC) No 842/2006 and Directive 2006/40/EC
4. Know the common procedures for recovering fluorinated greenhouse gases
5. Be able to demonstrate how to handle a refrigerant cylinder
6. Be able to connect and disconnect a recovery set to and from the service ports of a motor vehicle A/C system containing fluorinated greenhouse gases
7. Be able to operate a recovery set

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Know about the operation of A/C systems in motor vehicles	1.1 Identify the component parts of A/C systems 1.2 Describe operating principles of air conditioning systems
2. Know about the use and properties of the fluorinated greenhouse gases used as refrigerants in A/C systems in motor vehicles and the impact of the emissions of these gases on the environment (order of magnitude of their global warming potential in relation to climate change)	2.1 Outline the environmental issues relating to refrigerants 2.2 Explain related legislation and regulations when carrying out operations on mobile air conditioning systems 2.3 State the types, use and properties of fluorinated gases 2.4 Identify health risks associated with A/C systems and the appropriate health and safety measures to reduce these risks
3. Understand the relevant provisions of regulation (EC) No 842/2006 and Directive 2006/40/EC	3.1 Describe the main requirements of EC Regulation 842/2006 3.2 Describe the main requirements of Directive 2006/40/EC
4. Know the common procedures for recovering fluorinated greenhouse gases	4.1 Explain the procedures for recovering fluorinated greenhouse gases
6. Be able to demonstrate how to handle a refrigerant cylinder	5.1 Demonstrate the safe handling of refrigerant cylinders 5.2 Demonstrate the safe transfer of refrigerant to or from a cylinder
7. Be able to connect and disconnect a recovery set to and from the service ports of a motor vehicle A/C system containing fluorinated greenhouse gases	6.1 Identify the type of refrigerant being used on a vehicle 6.2 Locate and identify the A/C system service ports on a vehicle 6.3 Demonstrate the correct procedure for connecting and disconnection of the recovery set to and from the service ports of a motor vehicle
7. Be able to operate a recovery set	7.1 Demonstrate the correct operation of a recovery set

CONTENT

1.1.1. The component parts of an A/C systems to include:
- a. compressor
- b. condenser
- c. receiver drier
- d. suction accumulator
- e. expansion valve
- f. fixed orifice tube
- g. evaporator
- h. hoses

1.2.1. The operating principles of air conditioning systems to include:

a. heat transfer via:
- i. convection
- ii. conduction
- iii. radiation

b. humidity including:
- i. saturation
- ii. condensation
- iii. relative humidity

c. temperature:
- i. sensible heat
- ii. latent heat
- iii. difference between heat and temperature

d. pressure:
- i. atmospheric
- ii. absolute
- iii. effect on boiling point
- iv. compression
- v. units of measurement

e refrigeration cycle
- i. compression
- ii. condensation
- iii. evaporation

2.1.1 The environmental issues relating to refrigerants to include:
- a. Ozone layer and depletion
- b. Greenhouse effect
- c. Global warming potential
- d. Montreal protocol
- e. Kyoto agreement

2.2.1. Related legislation and regulations when carrying out operations on mobile air conditioning systems to include:
- a. EPA and effects of section 33 and 34 and legal disposal of waste
- b. COSHH
- c. waste transfer note
- d. all legal requirements relating to mobile air conditioning systems

CONTENT

2.3.1. Types, use and properties of fluorinated gases to include:
- a. properties
- b. characteristics
- c. R12 (CFC)
- d. R134a (HFC)
- e. Hydrocarbons
- f. blends (drop-ins)
- g. risks (flammability)
- h. risks (fractionation)

2.4.1. Health risks associated with A/C systems and the appropriate Health and Safety measures to reduce these risks to include:

a. PPE –fluoroelastomer gloves, protective goggles, safety boots, overalls
b. contact with skin
c. naked flame exposure
d. smoking danger
e. welding
f. ventilation
g. first aid

3.1.1 Basic knowledge of Regulations and Directives to include:
- a. Regulation (EC) No 842/2006
- b. Directive 2006/40/EC

4.1.1. Knowledge of recovery procedures to include:
- a. refrigerant specification and identification methods system recovery using appropriate equipment
- b. refrigerant state (liquid/vapour)
- c. gauges reading zero (atmospheric pressure) recovery equipment used in the procedure:
  - i. gauges
  - ii. lines and couplings
  - iii. recovery equipment
- e. how to select and check appropriate recovery cylinder to ensure fitness for use and determine the safe total and allowable filling weight
- f. methods of minimising refrigerant retention in oil
- g. methods which minimise the risk of refrigerant emission

5.1.1. The safe handling of refrigerant cylinders to include:
- a. storage
  - i. upright
  - ii. avoid heat sources including direct sunlight
  - iii. protection against frost
  - iv. accidental damage of valves
- b. transportation
  - i. upright
  - ii. labelling
  - iii. stacking

CONTENT

5.2.1. The transfer of refrigerant gas to or from a cylinder to include:
- a cylinders may be within service station or standalone
- b identify correct cylinder
- c connections
  - i. liquid and/or vapour connection
  - ii. connect to correct port

d. transfer of refrigerant
  - i. correct state
  - ii. minimum quantity transfer (50 grms)

e disconnection of recovery equipment

6.1.1. The identification of refrigerant to include:
- a. safe methods
- b. reference to vehicle specifications and using appropriate equipment

6.2.1. The location of A/C system service ports to include:
- a. confirm location of ports
- b. identify high and low pressure ports

6.3.1. The procedure for connecting and disconnection of the recovery set to and from the service ports of a motor vehicle to include:
- a safely connect the recovery set
- b safely disconnect the recovery set

7.1.1. The correct operation of a recovery set to include:
- a. selection of correct recovery equipment
- b. use the recovery equipment to carry out the full recovery of the F gas from a motor vehicle