Unit AE01 – Locate and Correct Motor Vehicle Electrical Faults

UNIT OVERVIEW

This unit is about conducting a range of routine electrical tests and identifying simple faults on a variety of basic electrical components and undertaking suitable correction activities.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

1. Examples of Electrical components are:
   a. power storage devices
   b. power generating devices
   c. vehicle starting devices
   d. vehicle lighting devices
   e. wiring harness and connection devices
   f. vehicle sensors and actuators
   g. circuit protection devices
   h. infotainment systems
   i. telematic / tracking systems
   j. security systems
   k. communication systems
   l. comfort systems
   m. safety systems
2. Electrical testing equipment covers:
   a. volt meters
   b. ammeters
   c. ohmmeters
   d. battery testing equipment
   e. diagnostic equipment
   f. oscilloscope

3. Tools and equipment:
   a. hand tools
   b. special purpose tools
   c. general workshop equipment
   d. specialist electrical testing equipment.

4. Electrical testing techniques are:
   a. voltage measuring
   b. current measuring
   c. resistance measuring
   d. visual
   e. aural
   f. functional

5. Electrical fault location within systems:
   - As listed within 1. above.

6. Rectification activities are defined as:

   An appropriate repair or replacement that rectifies the fault(s) identified from the diagnostic activities carried out. Post repair diagnostic confirmation of rectification.

ESSENTIAL KNOWLEDGE

You need to know and understand:

Legislative and organisational requirements and procedures

1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when carrying out electrical fault location and correction activities
2. statutory legal requirements relating to the vehicle and the components fitted
3. your workplace procedures for:
   - recording fault location and correction activities
• reporting the results of tests
• the referral of problems
• reporting delays to the completion of work

4. the importance of working to recognised diagnostic procedures and processes and obtaining the correct information for diagnostic activities to proceed.
5. the importance of working to agreed timescales and keeping others informed of progress.
6. the relationship between time and costs.
7. the importance of reporting any anticipated delays to the relevant person(s) promptly.

**Electrical and electronic principles**

8. vehicle earthing principles and earthing methods.
9. basic electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC), resistance, magnetism, electromagnetism and electromagnetic induction.
10. circuit protection.
12. how electrical / electronic systems within motor vehicles operate.
13. electrical / electronic symbols, units and terms.
14. how to interpret wiring diagrams.
15. the risks and dangers associated with hybrid and alternative fuel vehicles

**Use of electrical testing equipment and electrical testing techniques**

16. when and where to use voltage, ohm, amp and specific gravity measurements and simple circuit testing techniques.
17. how to measure voltage, resistance, current and specific gravity and simple circuit testing techniques to determine the cause(s) of a fault.
18. how to use the electrical testing equipment required.
19. how to conduct tests following electrical safety and workplace procedures.
21. how to determine the suitability of a component based upon calculations using ohms law
22. how to interpret the results of your tests.
23. how to make recommendations based upon the results of your tests.
24. the importance of basing your recommendations upon the results of your tests.

**Vehicle electrical equipment faults and their correction**

25. how to identify faults and damage in vehicle electrical systems through effective interpretation of test results
26. the common underlying causes of faults and damage within the electrical components.
27. the purpose and function of motors, capacitors, resistors, semi-conductors, transistors, actuators and sensors (including active or self-generating and passive or modulating).
28. how to dispose of any removed electrical components in line with legislation and organisational procedures.
29. how to perform safety and operational checks on the tools and equipment required to remove and replace electrical components.
30. how to check that any replaced electrical components are functioning correctly and the importance of doing so before release to the customer.
PERFORMANCE OBJECTIVES

To be competent you must:

a. Select and use appropriate personal protective equipment and use appropriate vehicle protection at all times
b. support the identification of electrical faults, by reviewing manufacturer:
   - technical data
   - diagnostic test procedures.
c. confirm that all equipment is safe prior to use
d. check the functionality of the electrical system(s) / component.
e. carry out tests on electrical system(s) relevant to the identified fault on the vehicle.
f. use electrical testing techniques which are suitable for the electrical system(s) / components concerned.
g. carry out all diagnostic & rectification activities following:
   - manufacturers’ procedures
   - industry recognised repair methods
   - health and safety requirements.
h. work in a way which minimises the risk of:
   - damage to other vehicle systems
   - damage to other components and units
   - contact with leakages
   - contact with hazardous substances.
   - injury to yourself and others
i. ensure your electrical testing techniques clearly identify the cause/s of identified fault/s and/or damage.
j. report the results of your tests and any recommendations for further action to the relevant person(s) clearly and accurately in an appropriate format, when necessary.
k. seek the assistance of the relevant person(s) promptly where the results of your testing are unclear.
l. ensure all removed, replaced and repaired components are secure and function as specified by the manufacturer prior to release to the customer.
m. dispose of any removed electrical components safely to comply with legal and environmental requirements in line with your workplace procedures
n. complete all electrical fault location and correction activities within the agreed timescale.
o. report any anticipated delays in completion to the relevant person(s) promptly.
Unit AE02 – Install Motor Vehicle Electrical System Enhancements

UNIT OVERVIEW

This unit is about fitting electrical features and components to enhance the original vehicle features and specification to meet customer requirements.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

1. Enhancements include:
   a. audio systems
   b. visual systems
   c. communication systems
   d. safety systems
   e. lamps
   f. tow bar electrical systems
   g. navigation systems
   h. security systems
   i. auxiliary power supplies
   j. telematics / vehicle location systems
   k. software modification

2. Tools and equipment include:
   a. hand tools
   b. specialist fitting tools
   c. general workshop equipment
   d. electrical and electronic testing equipment

ESSENTIAL KNOWLEDGE
You need to know and understand:

**Legislative and organisational requirements and procedures**

1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when fitting vehicle electrical enhancements.
2. the legal implications of the mechanical and electrical enhancement of vehicles.
3. your workplace procedures for
   - recording enhancement activities
   - recording functionality of enhancements
   - the referral of problems
   - reporting delays to the completion of work.
4. the importance of working to agreed timescales and keeping others informed of progress.
5. the relationship between time and costs.
6. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Tools and equipment**

7. how to prepare, test and use general workshop, special tools and appropriate testing equipment.

**Electrical and electronic principles**

8. vehicle earthing principles and earthing methods.
9. basic electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism, electromagnetic induction and EMF.
10. circuit protection devices.
11. electrical safety procedures.
12. electric symbols, units and terms
13. how charging, lighting and warning systems operate.
14. the risks and dangers associated with hybrid and alternative fuel vehicles
15. how charging, lighting and warning systems operate.
16. how enhancement opportunities may be limited by the existing vehicle systems and fitments.
17. the advantages and disadvantages of electrical customisation including possible impact on warranty and customers' vehicle insurance
18. manufacturers' requirements relating to the components to be fitted.
19. how to fit enhancements.
21. how to check that the components to be fitted are compatible with the vehicle specification and customer requirements.
22. how to check that newly fitted enhancements are functioning correctly and the importance of doing so before handover to the customer.
23. how to make adjustments to components and any surrounding systems to ensure correct operation.
24. how to work safely avoiding injury to yourself, others and damage to vehicles.

PERFORMANCE OBJECTIVES

To be competent you must:

a. select and use appropriate personal protective equipment and use appropriate vehicle protection at all times.
b. support your enhancement activities, by reviewing:
   - fitting procedures
   - technical data
   - legal requirements.
c. prepare and test all the tools and equipment required, following manufacturers’ instructions, prior to use.
d. fit components which are compatible with the vehicle specification and customer requirements.
e. carry out all enhancement activities following:
   - manufacturers’ procedures
   - your workplace procedures
   - health and safety requirements
   - legal requirements.
f. work in a way which minimises the risk of:
   - damage to other vehicle systems
   - damage to other components and units
   - contact with leakages
   - contact with hazardous substances
   - Injury to yourself and others.
g. If appropriate, adjust the enhancements fitted and vehicle systems to ensure that they comply with all relevant specification for effective operation.
h. ensure all enhancements function to specification prior to handover to the customer.
i. complete all enhancement activities within the agreed timescale.
j. report any anticipated delays in completion to the relevant person(s) promptly.
Unit AE03 – Repair and Overhaul Motor Vehicle Electrical Units

UNIT OVERVIEW

This unit is about the off vehicle repair and overhauling of electrical units and components.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Generators:

These can be externally and internally regulated.

Starters:

Examples include pre-engaged; inertia; axial and co-axial.

SCOPE OF THIS UNIT:

1. Electrical equipment is
   a. volt meters
   b. ammeters
   c. ohmmeters
   d. electrical insulation testing equipment

2. Testing methods are
   a. torque tests
   b. resistance tests
   c. insulation tests
   d. visual
   e. aural
   f. measurement

3. Repair activities are
   a. stripping
   b. cleaning and evaluating the unit
   c. soldering
   d. replacing faulty parts
   e. reassembly
4. Electrical units are
   a. generators
   b. starters
   c. motors
   d. actuators

**ESSENTIAL KNOWLEDGE**

You need to know and understand:

**Legislative an organisational requirements and procedures**

1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal protection when undertaking electrical unit repair activities.
2. your workplace procedures for
   - recording fault location and repair/correction activities
   - reporting the results of tests.
   - the referral of problems
   - reporting delays to the completion of work.
3. the importance of documenting repair/correction information.
4. the importance of working to agreed timescales and keeping others informed of progress.
5. the cost-benefit relationship between the reconditioning, repair and replacement of components within electrical units and components.
6. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Electrical principles**

7. the principles of electrical charging.
8. how starting, charging and electrical motor circuits work.
9. basic electrical and electronic principles, including Ohms Law, voltage, power, current (AD/DC) resistance, magnetism, electromagnetism and electromagnetic induction.
10. electrical symbols, units and terms.
11. the types of charging components, starting components and motors, and how they work.
12. how starter motor drive mechanisms work (including epicyclic gearing).
13. electrical safety procedures.

**Use of electrical testing equipment and electrical testing techniques**

14. how to prepare, assess and test the accuracy and operation of all the electrical repair and testing equipment required.
15. how to use all the electrical repair and testing equipment required.
16. how to interpret test results and perform electrical efficiency calculations.

**Charging system components, starting system components and motors**
fault finding and repair

17. how to find, interpret and use sources of information on electrical repair procedures.
18. manufacturers specifications for the units being repaired, and where this information can be sourced.
19. suppression requirements applicable to electrical components and the type and causes of faults which can occur in charging, starting and motor systems.
20. the purpose of, and when to use torque, resistance, insulation and visual tests.

21. how to test the internal components of an alternator including: diode pack, rotor field and stator windings.
22. the relationship between test methodology and the faults repaired – the use of appropriate testing methods.
23. how to assess the condition of components within charging system components, starting system components and motors and locate electrical faults.
24. how to repair charging system components, starting system components and motors.
25. how to test and evaluate the performance of repaired electrical components against the operating specification required.
26. how to carry out wiring harness repairs including soldering and crimping of wires and terminals.
27. how to identify the types and causes of alternator and starter failure.
28. how to make suitable adjustments to the starter drive setting.

PERFORMANCE OBJECTIVES

To be competent you must:

a. Select and use suitable personal protective equipment throughout all repair activities.
b. use suitable sources of technical information to support your repair activities.
c. assess and prepare all the electrical equipment required, following manufacturers’ instructions, prior to use.
d. use the electrical equipment required correctly and safely throughout all repairing activities.
e. carry out all repair activities following:

- manufacturers’ instructions
- recognised researched repair methods
- health and safety requirements.

f. work in a way which minimises the risk of:

- damage to other vehicle systems
- damage to other components and units
- contact with leakages
- contact with hazardous substances.

g. ensure your initial assessment and testing methods of electrical units identifies accurately their condition and suitability for reconditioning, repair or replacement.
h. inform the relevant person(s) promptly where a repair is uneconomic or unsatisfactory to perform.
i. use electrical **testing methods** which are suitable for assessing the performance of the type of **electrical unit** repaired.

j. when necessary, adjust electrical units and associated components to the specified settings correctly to ensure that they operate to requirements.

k. ensure repaired alternators and starters conform to the electrical efficiency operating specification required and any legal requirements.

l. ensure your repair records are accurate, complete and passed to the relevant person(s) promptly in the format required.

m. complete all repair activities within the agreed timescale.

n. report any anticipated delays in completion to the relevant person(s) promptly.
Unit AE04 – Diagnose and Rectify Motor Vehicle Drivetrain Electrical Faults

UNIT OVERVIEW

This unit is about diagnosing and rectifying electrical faults occurring within the vehicle drivetrain area.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Drivetrain:

All component(s) from the power source(s) to the driven wheels including interconnecting control systems

Electrical faults:

These are faults that require a multi stage inspection and a series of test results to identify the cause.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

1. Electrical faults occurring within the drivetrain include:

   a. starting and charging system
   b. engine management systems
   c. electronic clutch control system
   d. electronic gearbox control system
   e. electronic transmission control system
   f. electric retarder systems
   g. electronically controlled slip differential system
   h. traction control system
2. **Electrical and electronic testing equipment** covers:
   a. volt meters
   b. ammeters
   c. ohmmeters
   d. multimeters
   e. battery testing equipment
   f. dedicated and computer based diagnostic equipment
   g. oscilloscopes

3. **Tools and equipment:**
   a. hand tools
   b. special purpose tools
   c. general workshop equipment

4. **Diagnostic Testing is defined as:**
   a. Verify the fault
   b. Collect further information
   c. Evaluate the evidence
   d. Carry out further tests in a logical sequence
   e. Rectify the problem
   f. Check all systems

5. **Electrical and electronic testing techniques** are:
   a. voltage, resistance and current measuring
   b. frequency measuring
   c. visual
   d. dedicated and computer based testing

6. **Rectification activities** are defined as:
   A suitable repair or replacement that rectifies the fault(s) identified from the diagnostic activities carried out.

**ESSENTIAL KNOWLEDGE**

You need to understand:

**Legislative and organisational requirements and procedures**

1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying electrical faults.
2. statutory legal requirements relating to the vehicle and components fitted
3. your workplace procedures for
   - recording fault location and any necessary repair work
   - reporting the results of tests (internally and externally as appropriate)
4. the importance of working to recognised diagnostic procedures and processes and obtaining the correct information for diagnostic activities to proceed
5. the importance of, documenting diagnostic and rectification information.
6. the importance of working to agreed timescales and keeping others informed of progress.
7. the relationship between time, costs and profitability.
8. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Electrical and electronic principles**

9. electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism electromagnetic induction, EMC, digital and fibre optics principles
10. electrical symbols, units and terms.
11. electrical safety procedures.
12. how electrical and electronic units and components are constructed, dismantled and reassembled.
13. how electrical and electronic units and components operate, including electrical component function, electrical inputs, outputs, voltages and wave forms
14. the interaction between electrical, electronic and mechanical components within the systems defined.
15. how the drivetrain system components and circuits function.
16. how electrical systems interlink and interact, including networking protocols.

**Use of electrical testing equipment**

17. how to select and prepare for use the appropriate diagnostic testing equipment.
18. how to use **electrical and electronic testing equipment** to correctly and safely diagnose electrical faults

**Drivetrain electrical faults, their diagnosis and correction**

19. the types and causes of drivetrain electrical system, component and unit faults and failures.
20. drivetrain electrical component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.
21. how to find, interpret and use sources of information on drivetrain electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements.
22. how to carry out systematic diagnostic testing of electrical and electronic systems using **electrical testing techniques**.
23. how to select the most appropriate diagnostic testing method for the symptoms presented.
24. how to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.
25. how to rectify electrical and electronic faults.
26. how to check for current systems software version and updating process
27. how to make cost effective recommendations for rectification.
PERFORMANCE OBJECTIVES

To be competent you must:

a. Select and use appropriate personal protective equipment and use appropriate vehicle protection at all times.

b. Support the identification of electrical faults, by reviewing vehicle:
   • technical data
   • diagnostic test procedures.

c. Select and prepare for use the appropriate, required electrical and electronic testing equipment following manufacturers’ instructions prior to use.

d. Use electrical and electronic testing techniques which are relevant to the symptoms presented.

e. Collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of electrical system faults.

f. Identify and record any system deviation from acceptable limits accurately.

g. Make cost effective recommendations for rectification based upon your analysis of the diagnostic information gained.

h. Use all tools and equipment required for your diagnostic and rectification activities, correctly and safely throughout.

i. Carry out all diagnostic & rectification activities following:
   • manufacturers procedures
   • health and safety requirements.

j. Work in a way which minimises the risk of:
   • damage to other vehicle systems
   • damage to other components and units
   • contact with leakages
   • contact with hazardous substances.
   • Injury to yourself and others

k. Ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.

l. When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.

m. Ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to handover to the customer.

n. Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.

o. Complete all diagnostic and rectification activities within the agreed timescale.

p. Report any anticipated delays in completion to the relevant person(s) promptly.
Unit AE06 – Diagnose and Rectify Motor Vehicle Electrical Unit and Component Faults

UNIT OVERVIEW

This unit is about identifying and rectifying electrical faults occurring within a variety of electrical systems.

SCOPE OF THIS UNIT:

1. **Electrical faults** occurring within the following systems:
   a. Infotainment
   b. Comfort and Convenience
   c. Supplementary Restraint Systems (SRS)
   d. Networking Systems
   e. Body Electric Systems

2. **Electrical and electronic testing equipment** covers:
   a. volt meters,
   b. ammeters,
   c. ohmmeters
   d. multimeters
   e. battery testing equipment
   f. dedicated and computer based diagnostic equipment
   g. oscilloscopes

3. **Tools and equipment**:
   a. hand tools
   b. special purpose tools
   c. general workshop equipment

4. **Diagnostic Testing is defined as**:
   a. Verify the fault
   b. Collect further information
   c. Evaluate the evidence
   d. Carry out further tests in a logical sequence
   e. Rectify the problem
   f. Check all systems

5. **Electrical and electronic testing techniques** are:
a. voltage, resistance and current measuring 
b. frequency measuring 
c. visual 
d. dedicated and computer based testing 

6. **Rectification activities** are defined as: 
   
a. A suitable repair or replacement of a component(s) that rectifies the fault(s) identified 
   form the diagnostic activities carried out.

**ESSENTIAL KNOWLEDGE**

You need to understand:

**Legislative and organisational requirements and procedures**

1. the health and safety legislation and workplace procedures relevant to workshop practices and 
   personal and vehicle protection when diagnosing and rectifying complex electrical faults.
2. legal requirements relating to the vehicle electrics (including road safety and refrigerant 
   handling requirements).
3. your workplace procedures for
   - recording fault location and **correction activities**
   - reporting the results of tests.
   - the referral of problems
   - reporting delays to the completion of work
4. the importance of working to recognised diagnostic procedures and processes and obtaining 
   the correct information for diagnostic activities to proceed
5. the importance of, documenting diagnostic and rectification information.
6. the importance of working to agreed timescales and keeping others informed of progress.
7. the relationship between time, costs and profitability.
8. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Electrical and electronic principles**

9. electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) 
   resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre 
   optics principles.
10. electrical symbols, units and terms.
11. electrical safety procedures.
12. how electrical and electronic units and components are constructed, dismantled and 
    reassembled.
13. how electrical and electronic units and components operate, including electrical component 
    function, electrical inputs, outputs, voltage/current variation and patterns.
14. the interaction between electrical, electronic and mechanical components within the systems 
    defined.
15. how electrical systems interlink and interact, including multiplexing.
16. the operation of the electrical and electronic systems for electric, hybrid and alternative fuel vehicles (including regenerative braking systems).

Use of electrical testing equipment

17. how to prepare and test the accuracy of diagnostic testing equipment.
18. how to use **electrical and electronic testing equipment** to correctly and safely diagnose electrical faults

Auxiliary equipment electrical faults, their diagnosis and correction

19. the types and causes of electrical system, component and unit faults and failures.
20. electrical component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action.
21. how to find, interpret and use sources of information on electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements.
22. how to carry out systematic diagnostic testing of electrical and electronic systems using **electrical testing techniques**.
23. how to select the most appropriate diagnostic testing method for the symptoms presented.
24. how to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults.
25. how to rectify electrical and electronic faults
26. how to make suitable adjustments to components and units.
27. how to make cost effective recommendations for rectification.

**PERFORMANCE OBJECTIVES**

To be competent you must:

a. wear suitable personal protective equipment and use vehicle coverings when using **electrical testing techniques** and carrying out **rectification activities**.
b. support the identification of **electrical faults**, by reviewing vehicle:
   - technical data
   - diagnostic test procedures.
c. prepare, connect and test all the required **electrical and electronic testing equipment** following manufacturers' instructions prior to use.
d. use **electrical and electronic testing techniques** which are relevant to the symptoms presented.
e. collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of electrical system faults.
   - identify and record any system deviation from acceptable limits accurately.
   - make cost effective recommendations for rectification based upon your analysis of the diagnostic information gained.
f. use all **tools and equipment** required for your diagnostic and rectification activities, correctly and safely throughout.

**g. carry out all** diagnostic & rectification activities **following:**

- manufacturers’ instructions
- recognised researched repair methods (see guidance document)
- health and safety requirements.

**h. work in a way which minimises the risk of:**

- damage to other vehicle systems
- damage to other components and units
- contact with leakages
- contact with hazardous substances.

**i. ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.**

**j. when necessary, adjust components and units correctly to ensure that they operate to meet system requirements.**

**k. ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.**

**l. ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.**

**m. complete all diagnostic and rectification activities within the agreed timescale.**

**n. report any anticipated delays in completion to the relevant person(s) promptly.**
UNIT OVERVIEW

This unit is about identifying and fitting suitable supplementary locking and security devices that are permanently fitted to vehicles to deter theft.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

All of the items listed below form part of this National Occupational Standard

1. Examples of supplementary locks and security devices can be:
   a. electronic / electro mechanical lock mechanisms
   b. additional / supplementary mechanical door locks using cylinder type locks
   c. additional / supplementary mechanical door / aperture locks using external locking systems
   d. mechanical window protection devices (internal and external)
   e. replacement security windows / window security films
   f. pneumatic locking systems

2. Tools and equipment:
   a. hand tools
   b. special purpose tools
   c. general workshop equipment
   d. measuring equipment

ESSENTIAL KNOWLEDGE

You need to know and understand:

Legislative and organisational requirements and procedures
1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when fitting supplementary locks and security devices.
2. legal requirements relating to the vehicle and fitment of supplementary locks and security devices (including road safety, MOT, Construction and Use regulations and Type Approval).
3. your workplace procedures for
   - fitting supplementary locks and security devices
   - recording information.
   - the referral of problems
   - reporting delays to the completion of work
4. the importance of working to recognised procedures and processes and obtaining the correct information to enable fitting activities to proceed.
5. the importance of documenting information.
6. the importance of working to agreed timescales and keeping others informed of progress.
7. the relationship between time and costs
8. the importance of reporting anticipated delays to the relevant person(s) promptly.

Electrical and electronic principles

9. electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, EMC, digital and fibre optics principles.
10. electrical symbols, units and terms.
11. electrical safety procedures.
12. how electrical and electronic units and components are constructed, dismantled and reassembled.
13. how electrical and electronic units and components operate, including electrical component function, electrical inputs, outputs, voltages and patterns.
14. the interaction between electrical, electronic and mechanical components within the systems defined.
15. how vehicle electrical systems interlink and interact with supplementary vehicle locks and additional security devices, including networking protocols

Locking Device Principles and Operation.

16. the operating principle and construction of mechanical locking systems.
17. the operating principle and construction of pneumatic locking systems.
18. how locking systems (electrical, mechanical and pneumatic) can be integrated with Type Approved vehicle latches.

Mechanical/Electrical Competencies and Fitting principles

19. how to identify suitable supplementary locks and security devices for the type/use of vehicle
20. how to prepare, test and use all the equipment required for the fitting of supplementary locks and security devices.
21. how to use measuring devices in order to measure and mark out vehicles to enable the fitting of supplementary locks and security devices.
22. how to file, fit, tap, thread, cut and drill plastics and metals.
23. how to integrate vehicle electrical systems with supplementary locks and security devices (where applicable).
24. how to apply vehicle body anticorrosion treatment to meet vehicle requirements.
25. how to make suitable adjustments to components and units.
26. how to make cost effective recommendations for rectification.
27. how to work safely avoiding damage to other vehicle systems, components and units and contact with leakage and hazardous substances.

PERFORMANCE OBJECTIVES

To be competent you must:

a. Select and use suitable personal protective equipment and use appropriate vehicle protection at all times.

b. support the fitting of supplementary locks and security systems, by reviewing vehicle:

   - technical data
   - diagnostic test procedures.

c. prepare, connect and test all the required equipment following manufacturers' instructions prior to use.

d. collect sufficient information to enable an accurate fitting of supplementary locking and security devices.

e. use fitting techniques (both electrical and mechanical) which are relevant to the systems presented.

f. use the tools and equipment required, correctly and safely throughout all fitting activities.

g. make cost effective recommendations for the fitting of relevant supplementary locks and security devices according to the customers needs and vehicle type.

h. carry out all fitting activities following:

   - manufacturers' instructions
   - recognised researched repair methods
   - health and safety requirements.

i. work in a way which minimises the risk of:

   - damage to other vehicle systems
   - damage to other components and units
   - contact with leakages
   - contact with hazardous substances.

j. ensure all components and units conform to the vehicle operating specification and any legal requirements.
k. when necessary, adjust components and units correctly to ensure that they operate to meet system requirements.
l. ensure the systems fitted performs to the vehicle operating specification and any legal requirements prior to return to the customer.
m. ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.
n. complete all activities within the agreed timescale.
o. report any anticipated delays in completion to the relevant person(s) promptly.

Unit AE08 – Confirm the Functionality of Vehicle Electrical Systems using Prescribed Testing Methods

UNIT OVERVIEW

This unit is about carrying out a range of inspections on vehicles using a variety of prescribed testing and inspection methods.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Sources of technical information:

Examples include pre-determined / pre-printed inspection schedules, manufacturers’ manuals and Trade Association check lists, workplace procedures.

SCOPE OF THIS UNIT:

1. Vehicle inspections are
   a. pre-work
b. installed system functional check
c. post work
d. vehicle handover inspection

2. **Test methods** are
   
a. visual
b. aural
c. functional
d. measurement

3. **Examples of Equipment Includes:**
   
   Appropriate test equipment to correctly confirm the functionality of the system that you are inspecting; this may include measuring equipment, specialist diagnostic equipment or any type of tool required.

**ESSENTIAL KNOWLEDGE**

You need to know and understand:

**Legislative and organisational requirements and procedures**

1. the current health and safety legislation and workplace procedures relevant to conducting **vehicle inspections** and personal and vehicle protection.
2. the legislation relevant to the activities described in the Scoping Statement for this unit.
3. your workplace procedures for
   
   • recording **vehicle inspections** and any variations from acceptable methods and procedures
   • the referral of problems
   • reporting delays to the completion of work

4. the importance of making accurate records of the results of your tests and inspections and interpreting them correctly.
5. the importance of working to agreed timescales and keeping others informed of progress.
6. the relationship between time and costs.
1. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Sources of information**

8. how to find, interpret and use technical information.
2. the importance of using technical information to inform your inspection and testing of vehicles.

**Testing methods and the conduct of Inspections**

10. how vehicle systems operate and the operational tolerances for the vehicle(s) on which you are working.
11. how to follow procedures to carry out the systematic inspections described in the scoping statement above.
12. how to confirm the correct operation of vehicle systems and vehicle condition.
13. how to compare test and inspection results against vehicle specifications and legal requirements.
14. how to record test and inspection results in the format required.
15. how to make recommendations based upon the results of your inspections.
16. the implications of failing to carry out inspections activities correctly.
17. the implications of signing workplace documentation and vehicle records.

**PERFORMANCE OBJECTIVES**

To be competent you must:

a. Select and use suitable personal protective equipment throughout all vehicle inspection activities.

b. use suitable sources of technical information to support your vehicle inspection activities.

c. carry out systematic vehicle inspections following:
   - manufacturer’s approved procedures
   - recognised researched repair methods
   - health and safety requirements.
   - prescribed documentation

d. confirm all systems and components inspected, function correctly following the manufacturer’s specifications.

e. ensure your comparison of the vehicle against specification accurately identifies any:
   - differences from the vehicle specification
   - vehicle appearance and condition faults

f. work in a way which minimises the risk of damage to the vehicle and its systems, other people and their property.

g. make suitable recommendations for future action based upon the results of your tests and inspections.

h. ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required. (This includes all vehicle related paperwork).

i. complete all inspection activities within the agreed timescale and to specification.

j. report any anticipated delays in completion to the relevant person(s) promptly.
Unit AE09 – Identify Suitability, Installation and Configuration of Vehicle Enhancements and Vehicle Security Systems

UNIT OVERVIEW

This unit is about identifying electronic enhancements, vehicle electronic security systems and vehicle tracking systems for vehicle types to ensure that the vehicle enhancement meets the specification and functionality of the vehicle and also correctly installing those products to ensure that the vehicle systems function correctly after installation.

KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

1. Enhancements may include
   a. audio systems
   b. visual systems
   c. communication systems
   d. networking systems
   e. body electric systems
   f. data logging
   g. safety systems
   h. lighting systems
   i. tow bar electrical systems
   j. auxiliary power supplies
   k. telematics / vehicle location systems
   l. electronic security systems
   m. Software modification

2. Electronic Security Systems may include:
   a. alarm systems
   b. immobiliser systems
   c. location / tracking systems
3. **Electrical and electronic testing equipment** covers:
   
   a. volt meters  
   b. ammeters  
   c. ohmmeters  
   d. multimeters  
   e. dedicated and computer based diagnostic equipment  
   f. oscilloscopes

4. **Tools and equipment include:**
   
   a. hand tools  
   b. special purpose tools  
   c. general workshop equipment  
   d. electrical and electronic testing equipment?

**ESSENTIAL KNOWLEDGE**

You need to know and understand:

**Legislative and organisational requirements and procedures**

1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when enhancing vehicle systems  
2. legal requirements relating to the vehicle (including road safety requirements).  
3. your workplace procedures for  
   - recording fault location and correction activities  
   - reporting the results of tests.  
   - the referral of problems  
   - reporting delays to the completion of work

4. the importance of working to recognised procedures and processes and obtaining the correct information for enhancement activities to proceed and how to formulate and construct procedures and processes in order for enhancement activities to proceed.  
5. the importance of, documenting installation and enhancement information.  
6. the importance of working to agreed timescales and keeping others informed of progress.  
7. the relationship between time and costs  
8. the importance of reporting anticipated delays to the relevant person(s) promptly.

**Electrical and electronic principles**
9. electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, EMF digital and fibre optics principles.
10. electrical symbols, units and terms.
11. electrical safety procedures.
12. how electrical and electronic units and components operate, including electrical component function, electrical inputs, outputs, voltages/current levels and their associated patterns/waveforms.
13. the interaction between electrical, electronic and mechanical components within the systems defined.
14. how electrical systems interlink and interact, including networking protocols
15. the functionality of the electrical and electronic systems for electric, hybrid and alternative fuel vehicles.
16. how installed electronic enhancements interact with factory fit electronic components, including networking systems.

Use of electrical testing equipment

17. how to prepare and test the accuracy of diagnostic testing equipment.
18. how to use electrical and electronic testing equipment to correctly and safely test electrical and electronic systems.
19. how to find, interpret and use sources of information on electrical operating specifications and legal requirements.
20. how to use dedicated and computer based equipment to configure vehicle electronic controlled systems to operate correctly within legal requirements.
21. how to prepare and reconfigure electronically controlled vehicle enhancement systems to allow them to function correctly with factory fit vehicle systems.
22. how to rectify electrical and electronic faults, in standard and enhanced / modified systems.
23. how to make suitable adjustments to components and units.

PERFORMANCE OBJECTIVES

To be competent you must:

a. identify which vehicle electronic enhancement products meet the customers requirements and will also integrate fully with the vehicle factory fit electronic systems.
b. support the identification of suitable vehicle enhancement installations, by reviewing vehicle:
   • vehicle technical data
   • diagnostic test procedures.
   • customer requirements
   • electrical component technical data
c. select and use suitable personal protective equipment and use appropriate vehicle protection at all times,
d. prepare and test all the tools and equipment required, following manufacturers’ instructions, prior to use.
e. fit vehicle enhancement components which are compatible with the vehicle specification and customer requirements.

f. carry out all enhancement activities following:
   - manufacturers’ procedures
   - your workplace procedures
   - health and safety requirements
   - legal requirements.

g. work in a way which minimises the risk of:
   - damage to other vehicle systems
   - damage to other components and units
   - contact with leakages
   - contact with hazardous substances.
   - Injury to yourself and others

h. If appropriate, adjust the components fitted and vehicle systems (including any reconfiguration of electronic systems) to ensure that they comply with all relevant specification for effective operation.

i. ensure all vehicle enhancements made to the vehicle function to its specification.

j. ensure that all vehicle systems function correctly prior to handover to the customer.

k. complete all enhancement activities within the agreed timescale.

l. report any anticipated delays in completion to the relevant person(s) promptly.

m. if there are any issues with the vehicle enhancement liaise with other relevant person(s) (or with the customer) to agree the next course of action.

n. your records are complete, accurate, in the format required and signed by the customer, when necessary.

o. when appropriate, explain to customers any action that has been taken regarding their vehicle in non technical terms to give a clear understanding of the work carried out.

Unit AE10 – Conduct Vehicle Enhancement and Installation Consultations with Customers in the Motor Vehicle Environment

UNIT OVERVIEW

This unit is about carrying out consultations with customers to investigate their concerns relating to electrical enhancements for their vehicle. It also includes making recommendations to ensure that the customer’s concerns are addressed and explaining the outcomes that the enhancements will achieve so that customers fully understand the work that will be undertaken.
KEY WORDS AND PHRASES

Agreed timescales:

Examples include: manufacturer’s recommended work times, job times set by your company or a job time agreed with a specific customer.

Customer Reactions

Examples include anger, confusion, frustration.

Consultations with Customers

Examples include face to face and telephone conversations including questioning. It also includes giving technical advice, product information and clarification of technical issues after work has been completed.

Vehicles:

These can be any of the following – light vehicles, commercial vehicles, motorcycles, mopeds and scooters.

SCOPE OF THIS UNIT:

1. Enhancements may be within
   a. audio systems
   b. visual systems
   c. communication systems
   d. networking systems
   e. body electric systems
   f. data logging
   g. safety systems
   h. lighting systems
   i. tow bar electrical systems
   j. auxiliary power supplies
   k. telematics / vehicle location systems
   l. electronic security systems
   m. Software modifications

2. Electronic Security Systems may include:
   a. alarm systems
   b. immobiliser systems
   c. location / tracking systems
   d. electronic deadlocking systems

3. Electrical and electronic testing equipment includes:
a. volt meters  
 b. ammeters  
 c. ohmmeters  
 d. multimeters  
 e. dedicated and computer based diagnostic equipment  
 f. oscilloscopes  

4. **Tools and equipment includes:**  
   a. hand tools  
   b. special purpose tools  
   c. general workshop equipment  
   d. electrical and electronic testing equipment  

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**ESSENTIAL KNOWLEDGE**  
You need to know and understand:  

**Legislative and organisational requirements and procedures**  
1. the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when enhancing vehicle systems.  
2. legal requirements relating to the vehicle (including road safety requirements).  
3. your workplace procedures for  
   - recording fault location and correction activities  
   - reporting the results of tests.  
   - the referral of problems  
   - reporting delays to the completion of work.  
4. the importance of working to recognised procedures and processes and obtaining the correct information for enhancement activities to proceed and how to formulate and construct procedures and processes in order for enhancement activities to proceed.  
5. the importance of, documenting installation and enhancement information.  
6. the importance of working to agreed timescales and keeping others informed of progress.  
7. the relationship between time, costs and profitability.  
8. the importance of reporting anticipated delays to the relevant person(s) promptly.  

**Electrical and electronic principles**  
9. electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, EMF, digital and fibre optics principles.  
10. electrical symbols, units and terms.  
11. electrical safety procedures.  
12. how electrical and electronic units and components operate, including electrical component function, electrical inputs, outputs, voltage/current and their respective oscilloscope patterns.
13. the interaction between electrical, electronic and mechanical components within the systems defined.
14. how electrical systems interlink and interact, including networking protocols
15. the principle operation of the electrical and electronic systems for electric, hybrid and alternative fuel vehicles.
16. how installed enhancements will interact and influence with factory fit electrical components, including networking systems.

**Personal Skills**

17. how to give straightforward presentations on technical matters.
18. how to communicate effectively with and listen to customers.
19. how to present yourself in a positive and professional manner to customers.
20. how to recognise and handle different customer reactions.
21. how to adapt your language when explaining technical matters to customers.
22. how to use effective questioning techniques.
23. how to care for customers and achieve customer satisfaction.
24. your organisation's requirements for personal appearance and conduct when dealing with customers.

**PERFORMANCE OBJECTIVES**

To be competent you must:

a. respond to customer's concerns in a positive and friendly manner.
b. give a positive impression of yourself and your organisation when dealing with customers.
c. obtain sufficient, detailed information using suitably structured questions.
d. when appropriate, you carry out a suitable road test to obtain further detailed information on, or clarification of a customer's request.
e. provide customers with accurate, current and relevant advice and information on vehicle enhancement products.
f. support the identification of **suitable vehicle enhancement installations**, by reviewing vehicle:
   - vehicle technical data
   - diagnostic test procedures.
   - customer requirements
   - electrical component technical data

g. explain to the customer the implications of any enhancement(s) that may be needed clearly in simple and non complex terms.
h. give technical advice and information accurately, clearly and in a form and manner which the customer will understand using simple and non complex terms.
i. liaise with the customer and or other relevant person(s) to agree the next course of action.
j. when appropriate, explain to customers the action that has been taken regarding their vehicle clearly in simple and non complex terms.
k. when appropriate, ensure that your records are complete, accurate, in the format required and signed by the customer, when necessary.
Unit BP18 - Remove and Fit Basic Motor Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels

UNIT OVERVIEW

This unit is about the removal and fitting of mechanical, electrical and trim (MET) components to vehicles. It is also about checking the operation of the component(s) refitted to the vehicle.

SCOPE OF THIS UNIT:

1. **Basic MET components** includes:
   a. bumpers
   b. headlamp units
   c. road wheels
   d. batteries
   e. bonnet and boot lid trim
   f. interior trim components
   g. exterior trim components

2. **Non permanently attached body panels** are
   a. wings
   b. doors
   c. bonnets
   d. boot lids and tailgates
   e. bumper bars, covers and components

3. **Tools and equipment** are
   a. spanners
   b. socket set
   c. screwdrivers
   d. manufacturer’s specified specialist tools
   e. pliers and self locking grips
   f. power drill and drill bits
   g. trolley jack
   h. axle stands
   i. vehicle lifts
   j. torque wrench

1. suggest possible methods for improving the customer care process to your manager, when necessary.
ESSENTIAL KNOWLEDGE

You need to understand:

Legislative and organisational requirements and procedures

1. the health, safety and legal requirements relating to the removal and fitting of basic MET components and non welded non-structural body panels.
2. your workplace procedures for:
   - the referral of problems
   - reporting of delays to the completion of work
   - completion of work records.
3. the work that needs to be done and the standard required.
4. the requirements for protecting the vehicle and contents from damage before, during and after removing and fitting activities.
5. the importance of selecting, using and maintaining the appropriate personal protective equipment when removing and fitting basic MET components and non welded non-structural body panels.

Removing and fitting basic MET components

6. how to find, interpret and use sources of information applicable to the removal and fitting of basic MET components and non welded non-structural body panels.
7. how to select, check and use all the tools and equipment required to remove and fit basic MET components and non welded non-structural body panels.
8. the correct procedures for removing and fitting basic MET components and non welded non-structural body panels.
9. the correct procedures for working with supplementary safety systems when fitting and removing basic MET components and non welded non-structural body panels.
10. the correct procedures for working with Gas Discharge (High Intensity Discharge) headlight systems and when fitting and removing basic MET components and non welded non-structural body panels.
11. the methods of storing removed panels and components and the importance of storing them correctly
12. the different types of fastenings and fixings and the reasons for their use
13. the need for correct alignment of panels and components and the correct methods used to achieve this
14. the types of quality checks that can be used to ensure correct alignment and operation of components to manufacturer's specification and their purpose

PERFORMANCE OBJECTIVES

To be competent you must:

a  use the appropriate personal protective equipment when removing and fitting basic MET components and non welded non-structural body panels.

b  protect the vehicle and its contents effectively when removing and fitting basic MET components and non welded non-structural body panels.
c select and use the correct **tools and equipment** for the panels or components you are going to remove or fit.

d ensure that the **tools and equipment** you require are in a safe working condition.

e remove and fit **basic MET components and non welded non-structural body panels** following:

- removal and fitting procedures
- manufacturers’ instructions
- your workplace procedures
- health, safety and legal requirements

f avoid damaging other components, units and panels on the vehicle.

g store all removed panels and components safely in the correct location.

h realign the panels and components you have fitted correctly in a way which regains their original manufactured gaps.

i check that the components you have fitted operate correctly following the manufacturer’s specification.

j report any additional faults you find during the course of your work to the relevant person(s) promptly.

k report any delays in completing your work to the relevant person(s) promptly.

l remove and fit **basic MET components or non welded non-structural body panels** within the agreed timescale.

m complete work records accurately, in the format required and pass them to the relevant person(s) promptly.