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Locate and Correct Simple Electrical Faults

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.



Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

Produce evidence of locating and correcting electrical faults with **each** of the following systems and equipment:

1. the start/charge system
2. engine management and ignition systems
3. the lighting system.

Your tutor or assessor will either set and observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.



With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.



All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.



Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ

Information for N/SVQs

NVQ

SVQ

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
 - your normal workplace
 - and approved centre, or
 - a combination of both.
6. Simulated activities will be acceptable to assess candidates' identification of simple electrical faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be identified to ensure that all evidence requirements can be met.

Specific Performance Evidence for this Unit

You must:

7. produce evidence of locating and correcting **at least 9** electrical faults, comprising of **3 different faults** associated with **each** of the following systems and equipment:
 - a. the start/charge system
 - b. engine management and ignition systems
 - c. the lighting system

Your assessor must observe you locating and correcting **at least 1** electrical fault on **each** of the above types of systems.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.


All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Start/charge system 1				
Start/charge system 2				
Start/charge system 3				
Engine management and ignition systems 1				
Engine management and ignition systems 2				
Engine management and ignition systems 3				
Lighting system 1				
Lighting system 2				
Lighting system 3				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

<p>VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>	<p>N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>
<p>VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>	<p>N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>
<p>VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>	<p>N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>

Performance objective checklist

To be competent you must ensure that:	PRN
Wear suitable personal protective equipment and use vehicle coverings throughout all electrical fault location and correction activities.	
Confirm that all equipment is safe prior to use.	
Carry out tests on those electrical components relevant to the reported needs of the vehicle.	
Use electrical testing techniques which are suitable for the electrical components and systems concerned.	
Conduct all electrical testing techniques following: the electrical testing equipment manufacturer's instructions your workplace procedures health and safety requirements.	
Ensure your electrical testing techniques clearly identify the cause of identified faults.	
Report the results of your tests and any recommendations for further action to the relevant person(s) clearly and accurately, when necessary.	
Seek the assistance of the relevant person(s) promptly where the results of your testing are unclear.	
Complete all correction activities required effectively using suitable tools and equipment following: the electrical component manufacturer's instructions the vehicle manufacturer's instructions your workplace procedures health and safety requirements.	
Ensure all replaced and repaired electrical components are secure and function as required prior to release to the customer.	
Work in a way which minimizes the risk of damage to the vehicle and its systems.	
Dispose of any removed electrical components safely to comply with legal requirements and your workplace procedures.	
Complete all electrical fault location and correction activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical components are:	
a. batteries	
b. alternators	
c. starters	
d. fuses	
e. lighting and indicators	
f. engine management sensors and actuators.	
2. Electrical testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
e. battery testing equipment	
f. hand held diagnostic equipment	
g. test lamp.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical testing techniques are:	
a. voltage measuring	
b. ohm and amp measuring	
c. circuit testing	
d. visual	
e. aural.	
5. Electrical fault location within:	
a. the start/charge system	
b. engine management and ignition systems	
c. the lighting system.	
6. Correction activities are:	
a. replacing electrical components	
b. repairing wiring and connectors.	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The 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 requirements for vehicle lighting. 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - 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. Your workplace procedures for reporting the results of tests. 7. The importance of reporting any anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 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. Fuses and circuit protection devices. 11. Electrical safety procedures. 12. How lighting, warning, engine management and ignition, charging and starter circuits work. 13. Electric symbols, units and terms. 14. Battery charging. 	
<p>Use of electrical testing equipment and electrical testing techniques</p> <ol style="list-style-type: none"> 15. When and where to use voltage, ohm, amp and specific gravity measurements and simple circuit testing techniques. 16. How to use voltage, ohm, amp, specific gravity measuring and simple circuit testing techniques. 17. How to use the electrical testing equipment required. 18. How to conduct tests following electrical safety and workplace procedures. 19. How to calculate amps, ohms, and volts to determine component condition. 20. How to make recommendations based upon the results of your tests. 21. How to interpret the results of your tests. 22. The importance of basing your recommendations upon the results of your tests. 	
<p>Vehicle electrical equipment faults and their correction</p> <ol style="list-style-type: none"> 23. How to identify damage and simple faults in all vehicle electrical and electronic systems for the vehicles worked upon. 24. The causes of damage and faults within the electrical components listed above. 25. How to interpret simple wiring diagrams (including those for lighting, warning, engine management and ignition, charging and starter circuits). 26. The purpose, operating principles and location of batteries (including lead acid and alkaline types), generators (including generator systems, including dynamos, dynastart, alternators and current regulators), starters (including axial, co-axial, inertia and pre-engaged types), engine management electrical components (both petrol and diesel fuel injection), fuses, lighting units and indicator units for the vehicles worked upon. 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. Limits of wear and serviceability of the electrical components listed at iv. (above). 29. How to dispose of any removed electrical components. 30. How to perform safety and operational checks on the tools and equipment required to remove and replace electrical components. 31. How to check that any replaced electrical components are functioning correctly and the importance of doing so before release to the customer. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.2	Communication: Access 3, Outcomes 1 and 3
Application of Number: N2.1; N2.2	Numeracy: Access 3, Outcomes 1, 2 and 4
Information Technology: Not applicable	Information Technology: Not applicable
Working with Others: WO1.1; WO1.2	Working with Others: Access 3, Outcomes 1 and 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS2.1	Problem Solving: Intermediate 1, Outcome 1

Syllabus

Locate and correct simple electrical faults

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.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Demonstrate an understanding of the location of vehicle electrical systems and components and the procedures and equipment required for correction.
2. Demonstrate an understanding of the operating principles of vehicle electrical systems and components.
3. Demonstrate an understanding of removing and fitting electrical components.
4. Demonstrate an understanding of the procedure involved and the equipment needed to locate simple electric/electronic faults.
5. Describe the procedures for recording the results of rectification procedures.

Outcome 1

Demonstrate an understanding of the location of vehicle electrical systems and components and the procedures and equipment required for correction.

Objectives

To achieve this outcome a student has to:

- 1) Identify vehicle battery types
 - a) lead acid
 - b) alkaline.
- 2) Identify vehicle alternators.
- 3) Identify pre-engaged vehicle starter types.
 - a) axial
 - b) co-axial.
- 4) Identify vehicle electrical systems
 - a) windscreen wiper motors
 - b) windscreen washer motors
 - c) side lamps
 - d) headlamps
 - e) reversing lights
 - f) fog/spot lamps
 - g) brake lights
 - h) switches
 - i) electrically heated windows
 - j) electrically operated side and roof windows
 - k) electrically operated mirrors
 - l) electrically operated seats
 - m) security systems.
- 5) Identify vehicle indicator/hazard warning components.
- 6) Identify vehicle audio equipment
 - a) radio, aerial (antenna)
 - b) CD player
 - c) speakers.
- 7) Identify vehicle alarm components
 - a) alarm unit
 - b) sensors.
- 8) Identify circuit fuse types
 - a) blade
 - b) lug
 - c) in-line
 - d) circuit breaker.

- 9) Identify discreet components
 - a) resistors
 - b) capacitors
 - c) diodes
 - d) transistors
 - e) inductors.
- 10) Identify gauge components.
- 11) Identify sensors
 - a) variable resistors
 - b) reed relays
 - c) thermistors
 - d) parking and distance sensors
 - e) triggers
 - i. Hall effect
 - ii. reductor ring
 - iii. optical
 - f) diaphragm switch.
- 12) Identify actuators
 - a) solenoid
 - b) motorised
 - c) thermal.
- 13) Identify towing electrical connections.
- 14) Identify HGV applications including insulated earth return systems.
- 15) State how to prepare, test and use general workshop, special tools and appropriate testing equipment.
- 16) State how to interpret and follow technical instructions and customer requirements.
- 17) State the health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when rectifying electrical faults.

Outcome 2

Demonstrate an understanding of the function(s) and operating principles of vehicle electrical systems and components.

Objectives

To achieve this outcome a student has to:

- 1) Describe how to access data from various sources
 - a) workshop manuals
 - b) owners manual
 - c) manufacturer's data and information sheets
 - d) parts lists
 - e) VOSA (MOT) inspection manuals and guides
 - f) trade association checklists and charts
 - g) legal and technical data reference books
 - h) microfiche and computers.
- 2) Describe the functions and principles of operation of
 - a) lead acid and alkaline batteries
 - b) charging systems
 - c) starter systems
 - d) lighting systems
 - e) wiper/washer systems
 - f) electric motors
 - i. permanent magnet
 - ii. three brush.
- 3) Describe the functions and principles of operation of
 - a) resistors
 - b) capacitors
 - c) diodes
 - d) transistors
 - e) inductors.
- 4) Describe the functions and principles of operation of sensors
 - a) variable resistors-fuel level
 - b) reed relays - bulb failure
 - c) thermistors - water temperature
 - d) Hall effect - ignition trigger
 - e) reluctor ring - ignition trigger
 - f) optical - ignition trigger
 - g) diaphragm switches -oil pressure.
- 5) Describe the functions and principles of operation of
 - a) motorised - electric windows

- b) thermal - temperature gauge needle.
- 6) State the function of fuses in electrical circuits.
- 7) Describe the functions and principles of operation of
 - a) radio, aerial (antenna)
 - b) CD players
 - c) speakers.
- 8) State the operating principles of alarm systems.
- 9) State workplace procedures for
 - a) recording electrical rectification activities
 - b) the referral of problems
 - c) reporting delays to the completion of work.
- 10) State the importance of working to agreed timescales and keeping others informed of progress.
- 11) State the relationship between time and costs.
- 12) State the importance of reporting anticipated delays to the relevant person(s) promptly.

Outcome 3

Demonstrate an understanding of removing and fitting electrical components.

Objectives

To achieve this outcome a student has to:

- 1) Describe how to remove and replace
 - a) electrical components
 - b) trim
 - c) batteries, leads and terminals
 - d) starter systems
 - i. pre-engaged starter motors
 - ii. starter cables
 - iii. starter solenoids
 - e) charging systems
 - i. alternators
 - ii. drives
 - iii. connectors and cables
 - f) wiper/washer motors
 - g) lighting systems
 - h) indicator/hazard systems
 - i) audible warning systems
 - j) instruments
 - k) fuses
 - l) in-vehicle entertainment systems
 - m) anti-theft systems.
- 2) Describe how to remove and replace trim
 - a) door and side panels
 - b) carpets and protective mats
 - c) panels for access to in-vehicle entertainment components (e.g. radio/CD units)
 - d) protective covers for lighting units (e.g. boot lamp shields)
 - e) protective covers and materials surrounding electrical circuitry and components (e.g. relays, fuses solenoids).
- 3) State the current regulations relating to disposal of waste materials resulting from the preceding activities.
- 4) Describe how to check electrical systems are functioning correctly and the importance of doing so before release to the customer.
- 5) Carry out all electrical repair activities following:
 - a) manufacturers' instructions
 - b) your workplace procedures
 - c) health and safety requirements
 - d) legal requirements.

- 6) Work in a way which minimises the risk of damage to the vehicle and its systems.
- 7) When necessary, adjust the components fitted and vehicle systems correctly to ensure that they meet the manufacturer's specification for effective operation.
- 8) Ensure all rectified electrical systems function to specification prior to release to the customer.
- 9) Complete all electrical enhancement activities within the agreed timescale.
- 10) Report any anticipated delays in completion to the relevant person(s) promptly.

Outcome 4

Demonstrate an understanding of the procedure involved and the equipment needed to locate simple electric/electronic faults.

Objectives

To achieve this outcome a student has to:

- 1) Describe
 - a) procedure for collecting evidence relating to the suspected fault
 - b) describe a procedure for analysing the evidence
 - c) state the equipment used.
- 2) Describe
 - a) a procedure for collecting evidence relating to a fault in the charging system
 - b) a procedure for analysing the evidence collected.
 - c) the equipment used to locate simple faults in
 - i. charging systems
 - ii. starting systems
 - iii. lighting systems
 - iv. headlamp beam alignment on a vehicles
 - v. indicator and hazard warning systems
 - vi. windscreen and glasswear cleaning systems
 - vii. audible warning systems
 - viii. audio systems
 - ix. alarm and immobiliser systems.
- 3) State the relationship between
 - a) voltage, current and resistance
 - b) power, current and voltage.
- 4) State the symbols and conventional colour coding systems used in
 - a) driver information systems
 - b) circuit diagrams.

Outcome 5

Describe the procedures for recording the results of rectification procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting fault finding procedures
- 2) Procedures for recording fault finding activities
 - a) computer based
 - b) hard copy.
- 3) Procedures for recording the faults identified on components or units.
- 4) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 5) Procedures for
 - a) disposing of waste material resulting from the fault finding activities
 - b) returning defective units and components to storage or for re-cycling.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	5
2	6
3	6
4	6
5	2
Test duration 35mins	Total 25

Locate and Correct Electrical Faults

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.



Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

Produce evidence of locating and correcting **one** electrical fault associated with electrical components in **each** of the following systems:

- a. the starting and charging system
- b. communications and telematics systems
- c. the lighting system
- d. anti-theft, security and safety systems
- e. in-vehicle entertainment systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.



With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.



All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.



Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ

Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet **all** of the performance objectives consistently.
2. produce evidence to show that you have covered **all** the items listed in the scope for this unit.
3. Produce evidence to show that you possess **all** the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. be observed by a qualified assessor carrying out work in
 - your normal workplace
 - and approved centre, or
 - a combination of both.
6. **Simulated activities** will be acceptable to assess candidates' identification of simple electrical faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be identified to ensure that all evidence requirements can be met.

Specific Performance Evidence for this Unit

You must:

7. Produce evidence of locating and correcting **at least 10** electrical faults, comprising of **2 different faults** associated with electrical components in **each** of the following systems*:
 - a. the starting and charging system
 - b. communications and telematics systems
 - c. the lighting system
 - d. anti-theft, security and safety systems
 - e. in-vehicle entertainment systems.
8. Your assessor must observe you locating and correcting simple electrical faults on **at least 3 occasions**. **Each** observation **must** be of a fault from a different electrical system.

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of simple faults occurring in all the systems and equipment listed in the Scoping Statement for this unit. With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.


If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ

SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Starting and charging system 1			*	
Starting and charging system 2			*	
Communications and telematics systems 1			*	
Communications and telematics systems 2			*	
Lighting system 1			*	
Lighting system 2			*	
Anti-theft, security and safety systems 1			*	
Anti-theft, security and safety systems 2			*	
In-vehicle entertainment systems 1			*	
In-vehicle entertainment systems 2			*	

* **Three** observations needed

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

<p>VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name: Candidate enrolment number: Candidate signature: Date:</p>	<p>N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name: Candidate enrolment number: Candidate signature: Date:</p>
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Performance objective checklist

To be competent you must ensure that:	PRN
Wear suitable personal protective equipment and use vehicle coverings throughout all electrical fault location and correction activities.	
Confirm that all equipment is safe prior to use.	
Carry out tests on those electrical components relevant to the reported needs of the vehicle.	
Use electrical testing techniques which are suitable for the electrical components and systems concerned.	
Conduct all electrical testing techniques following: <ul style="list-style-type: none"> • the electrical testing equipment manufacturer's instructions • your workplace procedures • health and safety requirements. 	
Ensure your electrical testing techniques clearly identify the cause of identified faults.	
Report the results of your tests and any recommendations for further action to the relevant person(s) clearly and accurately, when necessary.	
Seek the assistance of the relevant person(s) promptly where the results of your testing are unclear	
Complete all correction activities required effectively using suitable tools and equipment following: <ul style="list-style-type: none"> • the electrical component manufacturer's instructions • the vehicle manufacturer's instructions • your workplace procedures • health and safety requirements. 	
Ensure all replaced and repaired electrical components are secure and function as required prior to release to the customer.	
Work in a way which minimizes the risk of damage to the vehicle and its systems.	
Dispose of any removed electrical components safely to comply with legal requirements and your workplace procedures.	
Complete all electrical fault location and correction activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical components are:	
a. batteries	
b. alternators	
c. starters	
d. fuses	
e. lighting and indicators	
f. engine management sensors and actuators.	
2. Electrical testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
e. battery testing equipment	
f. hand held diagnostic equipment	
g. test lamp.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical testing techniques are:	
a. voltage measuring	
b. ohm and amp measuring	
c. circuit testing	
d. visual	
e. aural.	
5. Electrical fault location within:	
a. the start/charge system	
b. engine management and ignition systems	
c. the lighting system.	
6. Correction activities are:	
a. replacing electrical components	
b. repairing wiring and connectors.	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The 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 requirements for vehicle lighting. 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - 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. Your workplace procedures for reporting the results of tests. 7. The importance of reporting any anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 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. Fuses and circuit protection devices. 11. Electrical safety procedures. 12. How lighting, warning, engine management and ignition, charging and starter circuits work. 13. Electric symbols, units and terms. 14. Battery charging. 	
<p>Use of electrical testing equipment and electrical testing techniques</p> <ol style="list-style-type: none"> 15. When and where to use voltage, ohm, amp and specific gravity measurements and simple circuit testing techniques. 16. How to use voltage, ohm, amp, specific gravity measuring and simple circuit testing techniques. 17. How to use the electrical testing equipment required. 18. How to conduct tests following electrical safety and workplace procedures. 19. How to calculate amps, ohms, and volts to determine component condition. 20. How to make recommendations based upon the results of your tests. 21. How to interpret the results of your tests. 22. The importance of basing your recommendations upon the results of your tests. 	
<p>Vehicle electrical equipment faults and their correction</p> <ol style="list-style-type: none"> 23. How to identify damage and simple faults in all vehicle electrical and electronic systems for the vehicles worked upon. 24. The causes of damage and faults within the electrical components listed above. 25. How to interpret simple wiring diagrams (including those for lighting, warning, engine management and ignition, charging and starter circuits). 26. The purpose, operating principles and location of batteries (including lead acid and alkaline types), generators (including generator systems, including dynamos, dynastart, alternators and current regulators), starters (including axial, co-axial, inertia and pre-engaged types), engine management electrical components (both petrol and diesel fuel injection), fuses, lighting units and indicator units for the vehicles worked upon. 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. Limits of wear and serviceability of the electrical components listed at iv. (Above). 29. How to dispose of any removed electrical components. 30. How to perform safety and operational checks on the tools and equipment required to remove and replace electrical components. 31. How to check that any replaced electrical components are functioning correctly and the importance of doing so before release to the customer. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.2	Communication: Access 3, Outcomes 1 and 3
Application of Number: N2.1; N2.2	Numeracy: Access 3, Outcomes 1, 2 and 4
Information Technology: Not applicable	Information Technology: Not applicable
Working with Others: WO1.1; WO1.2	Working with Others: Access 3, Outcomes 1 and 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS2.1	Problem Solving: Intermediate 1, Outcome 1

Syllabus

Locate and correct electrical faults

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

This unit is designed for those operating in the mobile electronics and security sector.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

- 1) Demonstrate an understanding of the operating principles vehicle electrical systems, components and accessories
- 2) Demonstrate an understanding of the use of tools and electrical testing equipment required for testing and diagnosis on vehicle electrical systems, components and accessories
- 3) Demonstrate an understanding of the procedures needed to locate electric/electronic faults in vehicle electrical systems, components and accessories and recommend rectification based on results
- 4) Demonstrate an understanding of the procedures needed for rectification of faults in vehicle electrical systems, components and accessories
- 5) Describe the procedures for recording the results of correcting electrical faults

Outcome 1

Demonstrate an understanding of the operating principles vehicle electrical systems, components and accessories

Objectives

To achieve this outcome a student has to:

- 1) State basic electrical and electronic principles
 - a) Ohms law
 - b) relationship between voltage, power, current (AC/DC) and resistance
 - c) magnetism
 - d) electromagnetism
 - e) electromagnetic induction.
- 2) State the purpose, operating principles and usual locations of
 - a) batteries
 - b) generators
 - c) pre-engaged starter motors (axial and co-axial)
 - d) fuses and circuit protection devices
 - e) lighting systems
 - f) towing electrical connections
 - g) earthing systems
 - h) capacitors
 - i) resistors
 - j) semi-conductors
 - k) transistors
 - l) actuators and sensors
 - m) active or self-generating
 - n) passive or modulating.
- 3) State the operational principles and usual locations of
 - a) communications and telematics systems
 - b) in-vehicle entertainment systems
 - c) anti-theft systems
 - d) safety device electrical fittings
 - e) security device electrical fittings.
- 4) State the meaning of electrical/electronic symbols and terms.
- 5) State the principles of battery charging.
- 6) State the electrical faults requiring a one-stage inspection with a single test result to identify them
 - a) battery discharge, gravity and voltage
 - b) alternator output, input and warning circuit faults
 - c) starter motor voltage, continuity, pinion condition and operation faults
 - d) fuse continuity
 - e) voltage and regulating faults

- f) lighting and indicator high resistance faults and earthing faults
 - g) bulb and voltage faults
 - h) switching faults
 - i) sensor and actuator faults.
- 7) State how to prepare, test and use general workshop, special tools and appropriate testing equipment.
 - 8) State how to interpret and follow technical instructions and customer requirements.
 - 9) State how to work safely avoiding personal injury or damage to vehicles.
 - 10) State the health and safety legislation and workplace procedures relevant to workshop and personal and vehicle protection when rectifying electrical faults.
 - 11) Wear suitable personal protective equipment and use vehicle coverings throughout all activities.
 - 12) Prepare and test all the tools and equipment required, following manufacturers' instructions, prior to use.
 - 13) Fit components which are compatible with the vehicle specification and customer requirements.

Outcome 2

Demonstrate an understanding of the use of tools and electrical testing equipment required for testing and diagnosis on vehicle electrical systems, components and accessories.

Objectives

To achieve this outcome a student has to:

- 1) State how to access data from various sources
 - a) workshop manuals
 - b) owners instructions
 - c) manufacturer's data, wiring diagrams and information sheets
 - d) parts lists
 - e) VOSA (MOT) inspection manuals and guides
 - f) trade association checklists and charts
 - g) legal and technical data reference books
 - h) computers.
- 2) State how to interpret wiring diagrams for
 - a) lighting systems
 - b) starter systems
 - c) charging systems
 - d) driver information and warning systems
 - e) engine management systems
 - f) ignition systems
 - g) towing electrical connections associated systems
 - h) in-vehicle entertainment systems
 - i) communications and telematic systems
 - j) anti-theft systems
 - k) safety systems.
- 3) State the use of
 - a) hand tools
 - b) continuity testers
 - c) voltmeters
 - d) ammeters
 - e) ohmmeters
 - f) multimeters
 - g) special purpose tools
 - h) dedicated diagnostic equipment.
- 4) State workplace procedures for
 - a) recording rectification activities
 - b) the referral of problems
 - c) reporting delays to the completion of work.
- 5) State the importance of working to agreed timescales and keeping others informed of progress.

- 6) State the relationship between time and costs.
- 7) State the importance of reporting anticipated delays to the relevant person(s) promptly.

Outcome 3

Demonstrate an understanding of the procedures needed to locate electric/electronic faults vehicle in electrical systems, components and accessories and recommend rectification based on results.

Objectives

To achieve this outcome a student has to:

- 1) Describe electrical testing and inspection techniques
 - a) measurement of voltage, current and resistance
 - b) circuit testing
 - c) visual inspection
 - d) aural assessment.
- 2) Describe the use of electrical testing equipment to establish voltage, current, resistance and continuity.
- 3) Describe how to calculate amps, ohms and volts to determine system or component condition.
- 4) Describe the procedures required to locate faults within
 - a) starting systems
 - b) charging systems
 - c) batteries
 - d) lighting systems
 - e) anti-theft systems
 - f) security systems and physical security devices
 - g) safety systems
 - h) in-vehicle entertainment systems
 - i) communications and telematic systems
 - j) towing electrical connections.
- 5) State the causes of damage and faults within the electrical systems and components listed in paragraph 4 (a to j).
- 6) State how to
 - a) interpret the results of the fault location tests
 - b) make recommendations for rectification based on interpretation of test results.
- 7) State the importance of basing recommendations for rectification upon the results of the fault location tests.
- 8) State the safety procedures associated with circuit testing to prevent
 - a) injury to the operator
 - b) damage to the vehicle and equipment.
- 9) State how to check that the electrical systems are functioning correctly and the importance of doing so before release to the customer.
- 10) State how to carry out all rectification activities following:
 - a) manufacturers' instructions
 - b) workplace procedures
 - c) health and safety requirements
 - d) legal requirements.
- 11) Work in a way which minimises the risk of damage to the vehicle and its systems.

- 12) Describe how to adjust the components fitted and vehicle systems correctly to ensure that they meet the manufacturer's specification for effective operation.
- 13) State the importance of ensuring all repaired units and systems function to specification prior to release to the customer.
- 14) **Importance of completing** rectification activities within the agreed timescale.
- 15) **Need to** report any anticipated delays in completion to the relevant person(s) promptly.

Outcome 4

Demonstrate an understanding of the procedures needed for rectification of faults in vehicle electrical systems, components and accessories.

Objectives

To achieve this outcome a student has to:

- 1) State the limits of wear and serviceability of the electrical systems and components for
 - a) batteries
 - b) generators
 - c) pre-engaged starter motors (axial and co-axial)
 - d) fuses and circuit protection devices
 - e) e) lighting systems
 - f) f) towing electrical connections
 - g) g) earthing systems
 - h) h) capacitors, resistors, semi-conductors and transistors
 - i) l) actuators and sensors
 - i. active or self-generating
 - ii. passive or modulating.
- 2) Describe how to carry out rectification procedures
 - a) replacing electrical components
 - b) repairing wiring and connectors.
- 3) Describe how to evaluate the condition of electrical circuits and associated components following rectification, and compare with
 - a) owners instructions
 - b) manufacturer's specifications
 - c) legal requirements.
- 4) State the current statutory requirements for vehicle lighting systems.
- 5) Describe a procedure
 - a) used to check that repaired electrical systems and components are functioning correctly and to meet legal requirements
 - b) the importance of checking the systems for operational efficiency before release to the customer.
- 6) State how to dispose of any removed electrical components.

Outcome 5

Describe the procedures for recording the results of rectification activity.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting rectification procedures.
- 2) Procedures for recording rectification activities
 - a) computer based
 - b) hard copy.
- 3) Procedures for recording the faults identified on components or units.
- 4) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 5) Procedures for
 - a) disposing of waste material resulting from the rectification activities
 - b) returning defective units and components to storage or for re-cycling.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	5
2	6
3	6
4	6
5	2
Test duration 35mins	Total 25

Enhance Vehicle Electrical System Features

 <p>Further guidance available</p>	 <p>Observation of your task/work</p>	 <p>Evidence recording</p>	 <p>Computer based testing</p>	 <p>Verbal Questioning</p>
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.



Information for VRQs (Technical Certificates).

To complete this unit you must:

produce evidence of carrying out different electrical enhancements to 3 out of the 10 systems below:

1. audio systems
2. visual systems
3. communications equipments
4. safety fitments
5. lamps
6. tow bar electrics
7. reversing aids
8. alarm system
9. navigation systems
10. immobiliser systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ



Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace.
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit

You must:

7. produce evidence of carrying out different electrical enhancements to 3 out of the 10* systems below:
 - audio systems
 - visual systems
 - communications equipments
 - safety fitments
 - lamps
 - tow bar electrics
 - reversing aids
 - alarm system
 - navigation systems
 - immobiliser systems.
8. Your assessor must physically observe you in your normal workplace successfully carrying out at least 1 enhancement of vehicle electrical system features.

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

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.


If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ

SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Carrying electrical enhancements 1				
Carrying electrical enhancements 2				
Carrying electrical enhancements 3				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

<p>VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>	<p>N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>
<p>VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>	<p>N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>
<p>VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>	<p>N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>

Performance objectives

To be competent you must:	PRN
Wear suitable personal protective equipment and use vehicle coverings throughout all electrical enhancement activities.	
Support your customisation activities, by reviewing: <ul style="list-style-type: none"> • fitting procedures • technical data • legal requirements. 	
Prepare and test all the tools and equipment required, following manufacturers' instructions, prior to use.	
Fit components which are compatible with the vehicle specification and customer requirements.	
Carry out all electrical enhancement activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements • legal requirements. 	
Work in a way which minimises the risk of damage to the vehicle and its systems.	
When necessary, adjust the components fitted and vehicle systems correctly to ensure that they meet the manufacturer's specification for effective operation.	
Ensure all newly fitted electrical enhancements function to specification prior to release to the customer.	
Complete all electrical enhancement activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Vehicle system enhancements are:	
a. audio systems	
b. visual systems	
c. communications equipment	
d. telematics systems	
e. anti-theft systems	
f. safety fitments	
g. physical security devices	
h. lamps	
i. tow bars	
j. vehicle racking installation	
k. vehicle panel lining.	
2. Tools and equipment are:	
a. hand tools	
b. power tools	
c. specialist fitting tools	
d. testing equipment.	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Essential Knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when fitting vehicle system enhancements 2. The legal implications of the mechanical and electrical customisation of vehicles. 3. your workplace procedures for <ul style="list-style-type: none"> - recording vehicle system enhancement activities - 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. 	
<p>Tools and equipment</p> <ol style="list-style-type: none"> 7. How to prepare, test and use hand and power tools, special tools and appropriate testing equipment. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 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. Fuses and circuit protection devices. 11. Electrical safety procedures. 12. How lighting, warning, engine management and ignition, charging and starter circuits work. 13. Electric symbols, units and terms. 14. Battery charging. 	
<p>Fitting vehicle enhancements</p> <ol style="list-style-type: none"> 15. The function and purpose of the vehicle system components you fit (e.g. in-vehicle entertainment systems, communications equipment, anti-theft systems, etc.) and how they operate. 16. How to interpret and follow technical instructions and customer requirements. 17. How enhancement opportunities may be limited by the existing vehicle systems and fitments. 18. The advantages and disadvantages of mechanical and electrical customisation. 19. Manufacturers' requirements relating to the components which you fit. 20. How to fit the vehicle system enhancements listed in the Scoping Statement for this unit. 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 vehicle system enhancements are functioning correctly and the importance of doing so before release to the customer 23. How to make adjustments to components and any surrounding systems to ensure effective working. 24. How to work safely avoiding damage injury to yourself and damage to vehicles. 	

<p>In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.</p>	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C2.2	Communication: Access 3, Outcome 3. Intermediate 1, Outcome 1
Application of Number: N2.1; N2.2	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: Not applicable	Information Technology: Not applicable
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS2.1; PS2.2; PS2.3	Problem Solving: Intermediate 1, Outcomes 1, 2 and 3

Syllabus

Enhance Vehicle Electrical System Features

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

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Demonstrate an understanding of the operating principles of electrical features and components used to enhance vehicle electrical systems to customise the original vehicle specification to meet customer requirements.
2. Demonstrate an understanding of the equipment needed to enhance vehicle electrical features and components.
3. Demonstrate an understanding of procedures required for fitting electrical features and components needed to enhance vehicle electrical features.
4. Demonstrate an understanding of the procedure involved and the equipment needed to check the operational efficiency and compliance with manufacturers/ legal requirements following enhancement of vehicle electrical systems.
5. Describe the procedures for recording the results of enhancement procedures.

Outcome 1

Demonstrate an understanding of the operating principles of electrical features and components used to enhance vehicle electrical systems to customise the original vehicle specification to meet customer requirements.

Objectives

To achieve this outcome a student has to:

- 1) State the basic operating principles of
 - a) audio systems
 - i. radio, aerials (antenna)
 - ii. CD player
 - iii. speakers
 - b) visual systems
 - c) communications equipment
 - d) safety fitments
 - e) additional driving lamps
 - f) towing electrical connections
 - g) reversing and forward motion warning aids (sensors)
 - h) navigation systems
 - i) alarm systems
 - j) immobiliser systems
 - k) satellite and micro-chip tracking systems.
- 2) Electrical and electronic systems
 - a) vehicle earthing systems
 - b) Ohms law including
 - i. voltage
 - ii. power
 - iii. current (AC & DC)
 - iv. resistance
 - c) magnetism
 - d) electromagnetism
 - e) electromagnetic induction.
- 3) Circuits and components
 - a) lighting circuits
 - b) charging circuits
 - c) starting circuits
 - d) warning circuits and audible alarms
 - e) engine management and ignition systems
 - f) electrical/electronic
 - i. symbols
 - ii. units
 - iii. terms

- g) fuses and circuit protection devices
 - h) battery charging.
- 4) Safety procedures which must be observed to prevent
- a) damage to the vehicle
 - b) damage to the unit or component
 - c) personal injury.

Outcome 2

Demonstrate an understanding of the equipment needed to enhance vehicle electrical features and components.

Objectives

To achieve this outcome a student has to:

- 1) State the equipment needed to enhance vehicle electrical features and components
 - a) hand and general purpose tools
 - b) specialist fitting tools and equipment
 - c) testing and analysing equipment.
- 2) State the method of using
 - a) specialist fitting tools and equipment
 - b) testing and analysing equipment.
- 3) State the procedures for obtaining and following
 - a) manufacturers instructions
 - b) customer requirements.
- 4) State the reasons why existing vehicle systems and fitments may limit additional enhancement.
- 5) State the methods used to prepare, test and use general workshop, special tools and appropriate testing equipment.
- 6) State the methods of interpreting and following technical instructions and customer requirements.
- 7) State the methods of working safely and avoiding personal injury or damage to vehicles.
- 8) State the health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when fitting vehicle electrical enhancements.
- 9) State the legal implications of the mechanical and electrical customisation of vehicles.
- 10) State the reasons for wearing suitable personal protective equipment and using vehicle coverings throughout all electrical enhancement activities.
- 11) State the preparation and testing procedures for the tools and equipment prior to use.
- 12) State the importance of only fitting components which are compatible with the vehicle specification and customer requirements.

Outcome 3

Demonstrate an understanding of procedures required for fitting electrical features and components needed to enhance vehicle electrical features.

Objectives

To achieve this outcome a student has to:

- 1) State the procedures for establishing the components to be installed are compatible with
 - a) vehicle specifications
 - b) customer requirements.
- 2) State the positions on the vehicle which are appropriate for installation of
 - a) radios, CD players aerials (antenna) and speakers
 - b) visual systems
 - c) communications equipment
 - d) safety fitments
 - e) additional driving lamps
 - f) towing electrical connections
 - g) reversing and forward motion warning aids (sensors)
 - h) navigation systems
 - i) alarm and immobiliser systems
 - j) satellite and micro-chip tracking systems.
- 3) State the procedures for installation of the units and components listed in paragraph 2 a to o.
- 4) Describe workplace procedures for
 - a) recording electrical enhancement activities
 - b) the referral of problems
 - c) reporting delays to the completion of work.
- 5) State the importance of working to agreed timescales and keeping others informed of progress.
- 6) State the relationship between time and costs.
- 7) State the importance of reporting anticipated delays to the relevant person(s) promptly.

Outcome 4

Demonstrate an understanding of the procedure involved and the equipment needed to check the operational efficiency and compliance with manufacturers/ legal requirements following enhancement of vehicle electrical systems.

Objectives

To achieve this outcome a student has to

- 1) State the procedures for checking the operational efficiency of enhances systems following installation
 - a) radios, CD players aerials (antenna) and speakers
 - b) visual systems
 - c) communications equipment
 - d) safety fitments
 - e) additional driving lamps
 - f) towing electrical connections
 - g) reversing and forward motion warning aids (sensors)
 - h) navigation systems
 - i) alarm and immobiliser systems
 - j) satellite and micro-chip tracking systems.
- 2) State the methods of checking the installation complies with
 - a) manufacturers specification
 - b) legal requirements.
- 3) State the procedures for adjusting the
 - a) systems listed in paragraph 1 a to j
 - b) existing surrounding or integrated systems.
- 4) State the importance of checking the newly fitted enhancements are functioning correctly before release to the customer.
- 5) State the reasons for working in a way which minimises the risk of injury or damage to the vehicle and its systems.
- 6) Procedures and reasons for adjusting components and vehicle systems to ensure that they meet the manufacturer's specification for effective operation.
- 7) State the need to ensure all newly fitted electrical enhancements function to specification prior to release to the customer.
- 8) State the need to complete all electrical enhancement activities within the agreed timescale.
- 9) State the importance of reporting any anticipated delays in completion to the relevant person(s) promptly.

Outcome 5

Describe the procedures for recording the results of enhancement procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting enhancement procedures
- 2) Procedures for recording enhancement activities
 - a) computer based
 - b) hard copy.
- 3) Procedures for recording the faults identified on components or units.
- 4) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 5) Procedures for
 - a) disposing of waste material resulting from the enhancement activities
 - b) returning defective units and components to storage or for
 - c) re-cycling, including refrigerant handling requirements.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	5
2	6
3	6
4	6
5	2
Test duration 35mins	Total 25

Enhance Vehicle System Features

 <p>Further guidance available</p>	 <p>Observation of your task/work</p>	 <p>Evidence recording</p>	 <p>Computer based testing</p>	 <p>Verbal Questioning</p>
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.



Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

produce evidence of carrying out **different enhancements** to **3 out of the following** systems:

1. audio systems
2. visual systems
3. communications equipments
4. telematics systems
5. anti-theft systems
6. safety fitments
7. physical security devices
8. lamps
9. tow bar electrics
10. vehicle racking installation
11. vehicle panel lining.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ



Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet **all** of the performance objectives consistently.
2. Produce evidence to show that you have covered **all** the items listed in the scope for this unit.
3. Produce evidence to show that you possess **all** the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace.
6. **Evidence from simulated activities is not acceptable for this unit.**
Specific Performance Evidence for this Unit.

You must:

7. Produce evidence of carrying out **different enhancements to 3 out of the 11*** systems below:
 - a. audio systems
 - b. visual systems
 - c. communications equipments
 - d. telematics systems
 - e. anti-theft systems
 - f. safety fitments
 - g. physical security devices
 - h. lamps
 - i. tow bar electrics
 - j. vehicle racking installation
 - k. vehicle panel lining
8. Your assessor must physically observe you **in your normal workplace** successfully carrying out **at least 1** enhancement of vehicle system features.

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of all the types of vehicle system enhancements listed.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.


Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ
SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Carrying electrical enhancements 1				
Carrying electrical enhancements 2				
Carrying electrical enhancements 3				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:	N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:
VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:	N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:
VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:	N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:

Performance objectives

To be competent you must:	PRN
Wear suitable personal protective equipment and use vehicle coverings throughout all electrical enhancement activities.	
Support your customisation activities, by reviewing: <ul style="list-style-type: none"> • fitting procedures • technical data • legal requirements. 	
Prepare and test all the tools and equipment required, following manufacturers' instructions, prior to use.	
Fit components which are compatible with the vehicle specification and customer requirements.	
Carry out all electrical enhancement activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements • legal requirements. 	
Work in a way which minimises the risk of damage to the vehicle and its systems.	
When necessary, adjust the components fitted and vehicle systems correctly to ensure that they meet the manufacturer's specification for effective operation.	
Ensure all newly fitted electrical enhancements function to specification prior to release to the customer.	
Complete all electrical enhancement activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Vehicle system enhancements are:	
a. audio systems	
b. visual systems	
c. communications equipment	
d. telematics systems	
e. anti-theft systems	
f. safety fitments	
g. physical security devices	
h. lamps	
i. tow bars	
j. vehicle racking installation	
k. vehicle panel lining.	
2. Tools and equipment are:	
a. hand tools	
b. power tools	
c. specialist fitting tools	
d. testing equipment.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when fitting vehicle system enhancements. 2. The legal implications of the mechanical and electrical customisation of vehicles. 3. Your workplace procedures for <ul style="list-style-type: none"> - recording vehicle system enhancement activities - 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. 	
<p>Tools and equipment</p> <ol style="list-style-type: none"> 7. How to prepare, test and use hand and power tools, special tools and appropriate testing equipment. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 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. Fuses and circuit protection devices. 11. Electrical safety procedures. 12. How lighting, warning, engine management and ignition, charging and starter circuits work. 13. Electric symbols, units and terms. 14. Battery charging. 	
<p>Fitting vehicle enhancements</p> <ol style="list-style-type: none"> 15. The function and purpose of the vehicle system components you fit (e.g. in-vehicle entertainment systems, communications equipment, anti-theft systems, etc.) and how they operate. 16. How to interpret and follow technical instructions and customer requirements. 17. How enhancement opportunities may be limited by the existing vehicle systems and fitments. 18. The advantages and disadvantages of mechanical and electrical customisation. 19. Manufacturers' requirements relating to the components which you fit. 20. How to fit the vehicle system enhancements listed in the Scoping Statement for this unit. 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 vehicle system enhancements are functioning correctly and the importance of doing so before release to the customer. 23. How to make adjustments to components and any surrounding systems to ensure effective working. 24. How to work safely avoiding damage injury to yourself and damage to vehicles. 	

<p>In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.</p>	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C2.2	Communication: Access 3, Outcome 3. Intermediate 1, Outcome 1
Application of Number: N2.1; N2.2	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: Not applicable	Information Technology: Not applicable
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS2.1; PS2.2; PS2.3	Problem Solving: Intermediate 1, Outcomes 1, 2 and 3

Syllabus

Enhance Vehicle System Features

This unit is about fitting electrical features including racking and panel linings where relevant to customise the original vehicle specification to meet customer requirements.

This unit is designed for those operating in the mobile electrics and security sector.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

- 1 Demonstrate an understanding of the operating principles of electrical features and components used to customise the original vehicle specification meet customer requirements.
- 2 Demonstrate an understanding of the tools, equipment components needed to customise vehicle electrical specification.
- 3 Demonstrate an understanding of procedures required for fitting electrical features and components needed to customise vehicle specification.
- 4 Demonstrate an understanding of the procedure involved and the equipment needed to check the operational efficiency and compliance with manufacturers/ legal requirements following customisation.
- 5 Describe the procedures for recording the results of enhancement activities.

Outcome 1

Demonstrate an understanding of the operating principles of electrical features and components used to customise the original vehicle specification meet customer requirements

Objectives

To achieve this outcome a student has to:

- 1) State the basic operating principles of
 - a) audio systems
 - b) i radios, speakers and aerials (antenna)
 - c) ii CD players
 - d) visual systems
 - e) communications equipment
 - f) telematics systems
 - g) anti-theft systems
 - h) safety fitments
 - i) additional lamps
 - j) tow bars and associated electrical/electronic systems.
- 2) Electrical and electronic systems
 - a) vehicle earthing principles and earthing methods
 - b) Ohms law including
 - i. voltage
 - ii. power
 - iii. current (AC & DC)
 - iv. resistance.
- 3) Circuits and components
 - a) lighting circuits
 - b) charging circuits
 - c) starting circuits
 - d) engine management and ignition systems
 - e) electrical/electronic
 - i. symbols
 - ii. units
 - iii. terms
 - f) fuses and circuit protection devices
 - g) battery charging.
- 4) Safety procedures which must be observed to prevent
 - a) damage to the vehicle
 - b) damage to the unit or component
 - c) personal injury.

Outcome 2

Demonstrate an understanding of the procedures tools, equipment components needed to customise vehicle electrical specification.

Objectives

To achieve this outcome a student has to state the

- 1) Equipment needed to enhance vehicle electrical features and components
 - a) hand and general purpose tools
 - b) specialist fitting tools and equipment
 - c) testing and analysing equipment
 - d) power tools.
- 2) Methods of using , preparing and testing
 - a) specialist fitting tools, power tools and equipment
 - b) testing and analysing equipment.
- 3) Procedures for obtaining and following
 - a) manufacturers instructions
 - b) customer requirements.
- 4) Specific
 - a) legal implications of the electrical and mechanical customisation of the vehicle
 - b) advantages and disadvantages of mechanical and electrical customisation.
- 5) Health and safety legislation and workplace procedures relating to workshop practices and personal and vehicle protection when fitting vehicle system enhancements.
- 6) Workplace procedures for
 - a) recording vehicle system enhancement activities
 - b) the referral of problems
 - c) reporting delays on the completion of work.
- 7) Importance of working to agreed timescales and keeping others informed of progress.
- 8) Relationship between time and costs.
- 9) Importance of promptly reporting anticipated delays to the relevant person(s).
- 10) Reasons why existing vehicle systems and fitments may limit additional enhancement.

Outcome 3

Demonstrate an understanding of procedures required for fitting electrical features and components needed to customise vehicle specification.

Objectives

To achieve this outcome a student has to state the

- 1) Procedures for establishing the components to be installed are computable with
 - a) vehicle specifications
 - b) customer requirements.
- 2) Positions on the vehicle which are appropriate for installation of
 - a) audio systems
 - i. radios, speakers and aerials (antenna)
 - ii. CD players
 - b) visual systems
 - c) communications equipment
 - d) telematics systems
 - e) anti-theft systems
 - f) safety fitments
 - g) additional lamps
 - h) tow bars and associated electrical/electronic systems
 - i) vehicle racking installations.
- 3) Procedures for installation of the units and components listed in paragraph 2 a to i.
- 4) Procedures for removing and refitting panel lining, carpets and insulating materials.

Outcome 4

Demonstrate an understanding of the procedure involved and the equipment needed to check the operational efficiency and compliance with manufacturers/ legal requirements following customisation.

Objectives

To achieve this outcome a student has to state the

- 1) Procedures for checking the operational efficiency of enhances systems following installation
 - a) audio systems
 - i. radios, speakers and aerials (antenna)
 - ii. CD players
 - b) visual systems
 - c) communications equipment
 - d) telematics systems
 - e) anti-theft systems
 - f) safety fitments
 - g) additional lamps
 - h) tow bars and associated electrical/electronic systems
 - i) vehicle racking installations.
- 2) Methods of checking the installation complies with
 - a) manufacturers specification
 - b) legal requirements.
- 3) Procedures for adjusting the
 - a) systems listed in paragraph 1 a to i
 - b) existing surrounding or integrated systems.
- 4) Importance of checking the newly fitted enhancements are functioning correctly before release to the customer.

Outcome 5

Describe the procedures for recording the results of enhancement activities.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting enhancement procedures.
- 2) Procedures for recording enhancement activities
 - a) computer based
 - b) hard copy.
- 3) Procedures for recording the faults identified on components or units.
- 4) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 5) Procedures for
 - a) disposing of waste material resulting from the removal and replacement activities
 - b) returning defective units and components to storage or for
 - c) re-cycling, including refrigerant handling requirements.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

Outcome	Number of questions
1	5
2	6
3	6
4	6
5	2
Test duration 35mins	Total 25

Repair Electrical Units

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.



Information for VRQs (Technical Certificates).

To complete this unit you must:

produce evidence of repairing a total of 4 electrical units, comprising of repairs to each of the following:

1. 2 different types of starters.
2. 2 different types of alternators.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ



Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
 - your normal workplace
 - and approved centre, or
 - a combination of both.
6. Simulated activities will be acceptable to assess candidates repairing electrical units where this activity does not occur at frequent intervals on vehicles within the normal workplace or the RWE environment, but which must be carried out to ensure that all evidence requirements can be met.

Specific Performance Evidence for this Unit

You must:

- produce evidence of repairing a total of 8 electrical units, comprising of 2 repairs to each of the following:
- 2 different types of starters
- 2 different types of alternators

Your assessor must physically observe you successfully repairing 1 starter and 1 generator on at least 1 occasion.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.


If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ

SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Starter repair 1				
Starter repair 2				
Starter repair 3				
Starter repair 4				
Generator repair 1				
Generator repair 2				
Generator repair 3				
Generator repair 4				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

<p>VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>	<p>N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:</p>
<p>VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>	<p>N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:</p>
<p>VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>	<p>N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick):</p> <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: <p>I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:</p>

Performance objective checklist

To be competent you must ensure that you:	PRN
Wear suitable personal protective equipment and use vehicle coverings throughout all electrical fault location and correction activities.	
Confirm that all equipment is safe prior to use.	
Carry out overhaul procedures following assessment and interpretation of results.	
Use electrical testing techniques which are suitable for the electrical components and systems concerned.	
Conduct all installation and testing techniques following: <ul style="list-style-type: none"> the electrical testing equipment manufacturer's instructions your workplace procedures health and safety requirements. 	
Seek the assistance of the relevant person(s) promptly where the installation process is unclear	
Complete all installation activities required effectively using suitable tools and equipment following: <ul style="list-style-type: none"> the electrical component manufacturer's instructions the vehicle or component manufacturer's instructions your workplace procedures health and safety requirements. 	
Ensure all overhauled components are secure and function as required prior to returning to storage.	
Work in a way which minimizes the risk of damage to the components or equipment.	
Dispose of any removed components safely to comply with legal requirements and your workplace procedures.	
Complete all electrical installation activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical equipment is	
a. volt meters	
b. ammeters	
c. ohmmeters	
d. insulation testing equipment.	
2. Testing methods are	
a. torque tests	
b. resistance tests	
c. insulation tests	
d. visual.	
3. Repair activities are	
a. stripping	
b. cleaning and evaluating the unit	
c. soldering	
d. replacing faulty parts	
e. reassembly	
f. testing.	
4. Electrical units are	
a. generators	
b. starters.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal protection when undertaking basic electrical unit repair activities. 2. Your workplace requirements for <ul style="list-style-type: none"> - recording repair activities - the referral of problems - reporting delays to the completion of work 3. The importance of, documenting repair 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 alternators and starters. 6. The importance of reporting anticipated delays to the relevant person(s) promptly. 	
<p>Electrical principles</p> <ol style="list-style-type: none"> 7. The principles of electrical charging. 8. How alternator and starter electrical 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 alternators and starters and how they work. 12. How starter motor drive mechanisms work. 13. Electrical safety procedures. 	
<p>Use of electrical testing equipment and electrical testing techniques</p> <ol style="list-style-type: none"> 14. How to prepare, and assess 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. 	
<p>Alternator and starter fault finding and repair</p> <ol style="list-style-type: none"> 17. How to find, interpret and use sources of information on electrical repair procedures. 18. Alternator and starter operating specifications and where this information can be sourced. 19. Suppression requirements applicable to alternators and starters. <p>The type and causes of faults which can occur in alternators and starters.</p> <ol style="list-style-type: none"> 20. The purpose of and when to use torque, resistance, insulation and visual tests. 21. How to test the diode pack, rotor field and stator windings of an alternator. 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 alternators and starters and find electrical faults. 24. How to repair alternators, starters. 25. How to test and evaluate the performance of repaired alternators and starters against the operating specification required. 26. How to solder materials together. 27. How to identify the types and causes of alternator and starter failure. 28. How to make suitable adjustments to the starter drive setting. 29. How to work safely avoiding personal injury and damage to components. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.3; C2.2	Communication: Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1
Application of Number: N2.1; N2.2; N2.3	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: Not applicable	Information Technology: Not applicable
Working with Others: WO1.1; WO1.2; WO1.3	Working with Others: Access 3, Outcomes 1, 2 and 3
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS3.1; PS3.2; PS3.3	Problem Solving: Intermediate 2, Outcomes 1, 2 and 3

Syllabus

Repair Electrical Units

This unit is about the bench based repair of basic electrical units

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Demonstrate an understanding of the operating principles of alternators and starter motors.
2. Demonstrate an understanding of the equipment required to overhaul alternators and starter motors.
3. Demonstrate an understanding of procedures required for cleaning, evaluation rectification and re-assembling alternators and starter motors.
4. Demonstrate an understanding of the procedures involved to test alternators and starter motors for operational efficiency following overhaul.
5. Describe the procedures for recording the results of repair activity.

Outcome 1

Demonstrate an understanding of the operating principles of alternators and pre-engaged starter motors.

Objectives

To achieve this outcome a student has to demonstrate

- 1) Basic operating principles of alternators and pre-engaged starter motors
 - a) electrical and electronic systems
 - b) Ohms law including
 - i. voltage
 - ii. power
 - iii. current (AC & DC)
 - iv. resistance
 - c) magnetism
 - d) electromagnetism
 - e) electromagnetic induction.
- 2) Meaning of electrical/electronic
 - a) symbols
 - b) units
 - c) terms.
- 3) Operating principles of different types of alternator and associated control systems.
- 4) Operating principles of and associated control systems for
 - a) pre-engaged starter motors
 - b) starter motor drive mechanisms.
- 5) Safety procedures which must be observed when working on alternators and starter motors to prevent
 - a) damage to the vehicle and workshop equipment
 - b) damage to the unit or component
 - c) personal injury.

Outcome 2

Demonstrate an understanding of the equipment required to overhaul alternators and starter motors.

Objectives

To achieve this outcome a student has to

- 1) State the equipment needed to overhaul alternators and pre-engaged starter motors
 - a) hand and general purpose tools
 - b) specialist fitting tools and equipment
 - c) voltmeters
 - d) ammeters
 - e) ohmmeters
 - f) multimeters
 - g) insulation testing equipment.
- 2) State the methods of using the equipment listed in paragraph 1 a to g.
- 3) State the procedures for obtaining and following
 - a) manufacturers instructions
 - b) customer requirements.
- 4) Demonstrate an understanding of the methods used to prepare, test and use general workshop, special tools and appropriate testing equipment.
- 5) State how to interpret and follow technical instructions and customer requirements.
- 6) State how to work safely avoiding personal injury or damage to vehicles.
- 7) state the health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when repairing electrical units.
- 8) State the need to wear suitable personal protective equipment and use vehicle coverings throughout all activities.
- 9) Demonstrate an understanding of the methods used to prepare and test all the tools and equipment required prior to use.
- 10) State the importance to fit only components which are compatible with the vehicle specification and customer requirements.

Outcome 3

Demonstrate an understanding of procedures required for cleaning, evaluation rectification and re-assembling alternators and starter motors

Objectives

To achieve this outcome a student has to describe the

- 1) Procedures for external cleaning and preparing
 - a) alternators for examination and assessment
 - b) pre-engaged starter motors for examination and assessment.
- 2) Testing methods used to assess alternators and pre-engaged starter motors prior to dismantling
 - a) torque tests
 - b) resistance tests
 - c) insulation tests
 - d) visual inspection
 - e) output tests.
- 3) Activities required to repair alternators and pre-engaged starter motors following evaluation of results from testing procedures
 - a) stripping
 - b) evaluation of internal condition
 - c) soldering
 - d) replacement of faulty components.
- 4) Re-assembly procedures required for alternators and pre-engaged starter motors following overhaul.
- 5) Workplace procedures for
 - a) recording rectification activities
 - b) the referral of problems
 - c) reporting delays to the completion of work.
- 6) Importance of working to agreed timescales and keeping others informed of progress.
- 7) Relationship between time and costs.
- 8) Importance of reporting anticipated delays to the relevant person(s) promptly.

Outcome 4

Demonstrate an understanding of the procedures involved to test alternators and starter motors for operational efficiency following overhaul and re-assembly.

Objectives

To achieve this outcome a student has to describe the

- 1) Procedures for checking the operational efficiency alternators and pre-engaged starter motors following overhaul
 - a) torque tests
 - b) resistance tests
 - c) insulation tests
 - d) output tests.
- 2) Methods of checking the overhauled unit complies with manufacturers specification.
- 3) Procedures for
 - a) returning the overhauled component to storage
 - b) recording overhaul procedures
 - c) disposal of waste materials.
- 4) Procedures for ensuring that rectified units are functioning correctly and the importance of doing so before release to the customer.
- 5) Need to work in a way which minimises the risk of injury or damage to the vehicle and its systems.
- 6) Importance of completing all repair activities within the agreed timescale.
- 7) Importance of reporting any anticipated delays in completion to the relevant person(s) promptly.

Outcome 5

Describe the procedures for recording the results of repair activities.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting rectification procedures.
- 2) Procedures for recording rectification activities
 - a) computer based
 - b) hard copy.
- 3) Procedures for recording the faults identified on components or units.
- 4) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 5) Procedures for
 - a) disposing of waste material resulting from the removal and replacement activities
 - b) returning defective units and components to storage or for re-cycling.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	5
2	6
3	6
4	6
5	2
Test duration 35mins	Total 25

Diagnose and Rectify Engine Electrical Faults

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.



Information for VRQs (Technical Certificates).

VRQ

To complete this unit you must:

Produce evidence of diagnosing and rectifying faults occurring in 3 of the following engine electrical system.

- a. starting and charging system
- b. ignition system
- c. petrol engine management system
- d. diesel engine management system
- e. electrical components of the cooling system.



Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.



With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.



All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently
2. produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in
 - your normal workplace
 - an approved centre, or
 - a combination of both
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit

You must:

7. Produce evidence of diagnosing and rectifying faults occurring in 3 out of the 5* engine electrical systems listed in the Scoping Statement (starting and charging system, ignition system, petrol engine management system, diesel engine management system, electrical components of the cooling system), at least 2 of which must come from work carried out in your normal workplace. Your evidence must also include use of at least 2 out of the 3* types of rectification activities listed in the Scoping Statement, both of which must have come from work carried out in your normal workplace.
8. Your assessor must physically observe you on at least 2 occasions, each observation covering the diagnosis and rectification of a fault in a different engine electrical system. At least 1 of these observations must be carried out in your normal workplace.

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

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.


If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ

SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Diagnosis and rectification of a fault in an engine electrical system 1				
Diagnosis and rectification of a fault in an engine electrical system 2				
Diagnosis and rectification of a fault in an engine electrical system 3				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:	N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:
VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:	N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:
VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:	N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:

Performance objectives

You must be able to:	PRN
Wear suitable personal protective equipment and use vehicle coverings when using electrical testing techniques and carrying out rectification activities .	
Support the identification of electrical faults , by reviewing vehicle: <ul style="list-style-type: none"> • technical data • diagnostic test procedures. 	
Prepare, connect and test all the required electrical testing equipment following manufacturers' instructions prior to use.	
Use electrical testing techniques which are relevant to the symptoms presented.	
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.	
Use the tools and equipment required, correctly and safely throughout all rectification activities.	
Carry out all rectification activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements. 	
Work in a way which minimises the risk of : <ul style="list-style-type: none"> • damage to other vehicle systems • damage to other components and units • contact with leakages • contact with hazardous substances. 	
Ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.	
When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.	
Ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.	
Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.	
Complete all system diagnostic activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical faults occurring within	
a. starting and charging system	
b. ignition system	
c. petrol engine management system	
d. diesel engine management system	
e. electrical components of the cooling system.	
2. Electrical and electronic testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
e. battery testing equipment	
f. hand held diagnostic equipment	
g. computer based diagnostic equipment	
h. test lamp.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical and electronic testing techniques are:	
a. voltage measuring	
b. ohm and amp measuring	
c. circuit testing	
d. visual	
e. aural	
f. computer based testing.	
5. Rectification activities are:	
a. replacing electrical components	
b. repairing wiring and connectors	
c. re-programming vehicle systems.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying engine electrical faults. 2. Legal requirements relating to the vehicle electrics (including road safety and refrigerant handling requirements). 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - the referral of problems - reporting delays to the completion of work. 4. The importance of, documenting diagnostic and rectification information. 5. The importance of working to agreed timescales and keeping others informed of progress. 6. The relationship between time, costs and profitability. 7. The importance of reporting anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 8. Electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre optics principles. 9. The principles of electrical charging. 10. How engine electrical and electronic systems are constructed, dismantled and reassembled. 11. How electrical and electronic engine systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns. 12. The interaction between electrical, electronic and mechanical components within vehicle engine systems. 13. Electrical symbols, units and terms. 14. Electrical safety procedures. 	
<p>Use of electrical testing equipment</p> <ol style="list-style-type: none"> 15. How to prepare and test the accuracy of diagnostic testing equipment 16. How to use electrical and electronic testing equipment 	
<p>Engine electrical faults, their diagnosis and correction</p> <ol style="list-style-type: none"> 17. The types and causes of engine electrical system, component and unit faults and failures. 18. Engine electrical component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action. 19. How to find, interpret and use sources of information on engine electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements. 20. The relationship between diagnostic methods and the symptoms presented by the vehicle. 21. How to carry out systematic diagnostic testing of engine electrical and electronic systems using electrical testing techniques. 22. How to select the most appropriate diagnostic testing method for the symptoms presented. 23. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults. 24. How to rectify electrical and electronic faults in electrical systems within the vehicle engine area (i.e. start/charge system, ignition system, petrol engine management system, diesel engine management system and electrical cooling system). 25. How to make suitable adjustments to components and units. 26. How to make cost effective recommendations for rectification. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.3; C2.2	Communication: Access 3, Outcomes 2 and 3 Intermediate 1, Outcome 1
Application of Number: N2.1; N2.2; N2.3?	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: ICT1.1; ICT1.2; ICT1.3?	Information Technology: Access 3, Outcomes 1, 2 and 3 (?)
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS3.1, PS3.2; PS3.3	Problem Solving: Intermediate 2, Outcomes 1, 2 and 3

Syllabus

Diagnose and rectify engine electrical faults

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

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle engine areas.
2. Describe the types and causes of vehicle engine electrical systems, component and unit faults and failures, and how to carry out systematic diagnostic testing of these systems and components.
3. Describe the procedures for rectifying electrical and electronic faults in the vehicle engine areas.
4. Describe the procedures for recording the results of rectification procedures.

Outcome 1

Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle engine areas.

Objectives

To achieve this outcome a student has to describe the

- 1) Preparation of the tools and equipment used for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle transmission and chassis areas
 - a) hand tools
 - b) special purpose tools
 - c) general workshop equipment
 - d) voltmeters
 - e) ammeters
 - f) ohmmeters
 - g) multimeters
 - h) battery testing equipment
 - i) hand held diagnostic equipment
 - j) computer based diagnostic equipment
 - k) test lamps
 - l) oscilloscopes
 - m) logic probes.
- 2) Procedures for
 - a) preparing, connecting and testing all the required electrical diagnostic, testing and rectification equipment prior to use
 - b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
 - c) using the tools and equipment correctly and safely at all times.
- 3) Procedures used to obtain and check the data required for diagnosis and rectification.
- 4) Procedures for using the tools and equipment needed for diagnosis and rectification.

Outcome 2

Describe the types and causes of vehicle engine electrical systems, component and unit faults and failures, and how to carry out systematic diagnostic testing of these systems and components,

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic techniques used for fault diagnosis
 - a) voltage measurement
 - b) ohm and amp measurement
 - c) circuit testing
 - d) visual
 - e) aural
 - f) computer based,
- 2) Faults occurring in
 - a) starting and charging systems
 - b) ignition systems
 - c) petrol engine management systems
 - d) diesel engine management systems
 - e) electrical components of cooling systems.
- 3) Methods of rectifying the faults listed above in paragraph 2 (a to e).
- 4) Methods of finding, interpreting and using information prior to diagnosis and repair to ensure the systems and units will comply with
 - a) legal requirements
 - b) manufacturers specifications for
 - i. repair procedures
 - ii. limits, tolerances and fits.
- 5) Health and safety legislation and employers workshop practices relating to
 - a) personal protection
 - b) vehicle protection
 - c) recording fault location and rectification activities
 - d) referral of problems
 - e) reporting delays to the completion of work
 - f) importance of working to agreed timescales and keeping others informed of progress
 - g) relationship between time, costs and profitability
 - h) importance of reporting anticipated delays promptly.
- 6) Way in which engine electrical and electronic systems operate including
 - a) electrical component function
 - b) electrical inputs
 - c) electrical outputs
 - d) voltages and patterns.

Outcome 3

Describe the procedures for rectifying electrical and electronic faults in the vehicle engine areas.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic principles
 - a) Ohms law
 - b) voltage
 - c) power
 - d) current – (AC/DC)
 - e) resistance
 - f) magnetism, electromagnetism and electromagnetic induction
 - g) digital and fibre optics.
- 2) Principles of electrical charging.
- 3) Electrical symbols, units and terms.
- 4) Way in which engine electrical systems related electrical and electronic systems are
 - a) connected
 - b) dismantled
 - c) rectified
 - d) re-assembled
 - e) replaced.
- 5) Reasons why failure has occurred.
- 6) Recommendations based upon the inspection procedures
 - a) servicing
 - b) repair
 - c) replacing electrical components
 - d) repairing wiring and connectors
 - e) re-programming vehicle systems.
- 7) How to select the most appropriate methods of diagnosis.
- 8) Rectifications within the engine electrical systems areas
 - a) electrical component function
 - b) electrical inputs and outputs
 - c) voltages
 - d) oscilloscope patterns.
- 9) Interaction between electrical, electronic and mechanical components.
- 10) Engine, transmission and chassis electrical systems interlink, interact (including multiplexing).
- 11) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer.

Outcome 4

Describe the procedures for recording the results of rectification procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting diagnostic and rectification information.
- 2) Procedures for recording diagnostic and rectification activities
 - a) computer based
 - b) hard copy.
- 3) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 4) Procedures for
 - a) disposing of waste material resulting from the diagnostic and rectification activities
 - b) returning defective units and components to storage or for re-cycling.
- 5) Importance of working to agreed timescales and keeping others informed of progress.
- 6) Relationship between time, costs and profitability.
- 7) Importance of reporting anticipated delays to the relevant person(s) promptly.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	6
2	9
3	7
4	3
Test duration 35mins	Total 25

Diagnose and Rectify Transmission and Chassis Electrical Faults

 <p>Further guidance available</p>	 <p>Observation of your task/work</p>	 <p>Evidence recording</p>	 <p>Computer based testing</p>	 <p>Verbal Questioning</p>
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.



Information for VRQs (Technical Certificates).

To complete this unit you must:

Produce evidence of diagnosing and rectifying faults occurring in 3 of the following transmission and chassis electrical systems:

- a. electronic clutch control system
- b. electronic gear box control system
- c. electronic automatic gear box control system
- d. electric retarder systems
- e. electronically controlled slip differential system
- f. electronic suspension control system
- g. ABS and traction control system
- h. electric/electronic steering control systems
- i. electronic stability control systems.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ



Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace
6. Evidence from simulated activities is not acceptable for this unit.

Specific Performance Evidence for this Unit

You must:

7. produce evidence of diagnosing and rectifying faults occurring in 3 out of the 9* transmission and chassis electrical systems listed in the Scoping Statement, at least 2 of which must come from work carried out in your normal workplace. Your evidence must also include use of all the types of rectification activities listed in the Scoping Statement, all of which must come from your normal workplace.
8. Your assessor must physically observe you on at least 2 occasions, each observation covering the diagnosis and rectification of a fault in a different transmission and or chassis electrical system.

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

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the task you are performing.


If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ

SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Diagnosis and rectification of a fault in a transmission or chassis electrical system 1				
Diagnosis and rectification of a fault in a transmission or chassis electrical system 2				
Diagnosis and rectification of a fault in a transmission or chassis electrical system 3				

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:	N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:
VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:	N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:
VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:	N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:

Performance objectives

You must be able to:	PRN
Wear suitable personal protective equipment and use vehicle coverings when using electrical testing techniques and carrying out rectification activities .	
Support the identification of electrical faults , by reviewing vehicle: <ul style="list-style-type: none"> • technical data • diagnostic test procedures. 	
Prepare, connect and test all the required electrical testing equipment following manufacturers' instructions prior to use.	
Use electrical testing techniques which are relevant to the symptoms presented.	
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.	
Use the tools and equipment required, correctly and safely throughout all rectification activities.	
Carry out all rectification activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements. 	
Work in a way which minimises the risk of : <ul style="list-style-type: none"> • damage to other vehicle systems • damage to other components and units • contact with leakages • contact with hazardous substances. 	
Ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.	
When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.	
Ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.	
Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.	
Complete all system diagnostic activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical faults occurring within:	
a. electronic clutch control system	
b. electronic gear box control system	
c. electronic automatic gear box control system	
d. electric retarder systems	
e. electronically controlled slip differential system	
f. electronic suspension control system	
g. ABS and traction control system	
h. electric/electronic steering control systems	
i. electronic stability control systems.	
2. Electrical and electronic testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
e. battery testing equipment	
f. hand held diagnostic equipment	
g. computer based diagnostic equipment.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical and electronic testing techniques are:	
a. voltage measuring	
b. ohm and amp measuring	
c. circuit testing	
d. visual	
e. aural	
f. computer based testing.	
5. Correction activities are:	
a. replacing electrical components	
b. repairing wiring and connectors.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying transmission and chassis electrical faults. 2. Legal requirements relating to the vehicle electrics (including road safety requirements). 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - the referral of problems - reporting delays to the completion of work. 4. The importance of, documenting diagnostic and rectification information. 5. The importance of working to agreed timescales and keeping others informed of progress. 6. The relationship between time, costs and profitability. 7. The importance of reporting anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 8. Electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre optics principles. 9. The principles of electrical charging. 10. Electrical symbols, units and terms. 11. Electrical safety procedures. 12. How transmission and chassis related electrical and electronic systems are constructed, dismantled and reassembled. 13. How transmission and chassis electrical and electronic systems operate, including electrical component function, electrical inputs, outputs, voltages and patterns. 14. The interaction between electrical, electronic and mechanical components within the vehicle's transmission and chassis systems. 15. How the transmission and chassis electrical systems interlink and interact, including multiplexing. <p>Use of electrical testing equipment</p> <ol style="list-style-type: none"> 16. How to prepare and test the accuracy of diagnostic testing equipment. 17. How to use electrical and electronic testing equipment. 	
<p>Transmission and chassis electrical faults, their diagnosis and correction</p> <ol style="list-style-type: none"> 18. The types and causes of transmission and chassis electrical system, component and unit faults and failures. 19. Transmission and chassis electrical component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action. 20. How to find, interpret and use sources of information on transmission and chassis electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements. 21. The relationship between diagnostic methods and the symptoms presented by the vehicle. 22. How to carry out systematic diagnostic testing of transmission and chassis 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 in electrical systems within the vehicle transmission and chassis area (ie electronic clutch control system, electronic gear box control system, electronic automatic gear box control system, electric retarder systems, electronically controlled slip differential system, electronic suspension control system, ABS and traction control system, electric/electronic steering control systems, electronic stability control systems). 26. How to make suitable adjustments to components and units. 27. How to make cost effective recommendations for rectification. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.3; C2.2;	Communication: Access 3, Outcomes 2 and 3 Intermediate 1, Outcomes 1
Application of Number: N2.1; N2.2; N2.3?	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: ICT1.1; ICT1.2; ICT1.3?	Information Technology: Access 3, Outcomes 1, 2 and 3?
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS3.1; PS3.2; PS3.3	Problem Solving: Intermediate 2, Outcomes 1, 2 and 3

Syllabus

Diagnose and rectify Transmission and Chassis Electrical Faults

This unit is about identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle transmission and chassis areas.

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle transmission and chassis areas.
2. Describe the types and causes of transmission and chassis electrical systems, component and unit faults and failures, and how to carry out systematic diagnostic testing of these systems and components.
3. Describe the procedures for rectifying electrical and electronic faults in the transmission and chassis areas.
4. Describe the procedures for recording the results of rectification procedures.

Outcome 1

Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle transmission and chassis areas.

Objectives

To achieve this outcome a student has to describe the

- 1) Preparation of the tools and equipment used for identifying and rectifying electrical faults occurring within a variety of electrical systems within the vehicle transmission and chassis areas
 - a) hand tools
 - b) special purpose tools
 - c) general workshop equipment
 - d) voltmeters
 - e) ammeters
 - f) ohmmeters
 - g) multimeters
 - h) battery testing equipment
 - i) hand held diagnostic equipment
 - j) computer based diagnostic equipment
 - k) test lamps
 - l) oscilloscopes
 - m) logic probes.
- 2) Procedures for
 - a) preparing, connecting and testing all the required electrical diagnostic and testing equipment prior to use
 - b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
 - c) using the tools and equipment correctly and safely at all times.
- 3) Procedures used to obtain and check the data required for diagnosis.
- 4) Procedures for using the tools and equipment needed for diagnosis.

Outcome 2

Describe the types and causes of transmission and chassis electrical systems, component and unit faults and failures, and how to carry out systematic diagnostic testing of these systems and components.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic techniques used for fault diagnosis
 - a) voltage measurement
 - b) ohm and amp measurement
 - c) circuit testing
 - d) visual
 - e) aural
 - f) computer based.
- 2) Faults occurring in
 - a) electronic clutch control systems
 - b) electronic gearbox control systems
 - c) electronic automatic gearbox control systems
 - d) electric retarder systems
 - e) electronically controlled slip differential systems
 - f) electronic suspension control systems
 - g) ABS and traction control systems
 - h) electrical/electronic steering control systems
 - i) electronic stability control systems.
- 3) Methods of rectifying the faults listed above in paragraph 2 (a to i).
- 4) Methods of finding, interpreting and using information prior to diagnosis to ensure the systems and units will comply with
 - a) legal requirements
 - b) manufacturers specifications for
 - i. repair procedures
 - ii. limits, tolerances and fits.
- 5) Health and safety legislation and employers workshop practices relating to
 - a) personal protection
 - b) vehicle protection
 - c) recording fault location and rectification activities
 - d) referral of problems
 - e) reporting delays to the completion of work
 - f) importance of working to agreed timescales and keeping others informed of progress
 - g) relationship between time, costs and profitability
 - h) importance of reporting anticipated delays promptly.
- 6) Way in which transmission and chassis electrical and electronic systems operate including
 - a) electrical component function

- b) electrical inputs
- c) electrical outputs
- d) voltages and patterns.

Outcome 3

Describe the procedures for rectifying electrical and electronic faults in the transmission and chassis areas.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic principles
 - a) Ohms law
 - b) voltage
 - c) power
 - d) current – (AC/DC)
 - e) resistance
 - f) magnetism, electromagnetism and electromagnetic induction
 - g) digital and fibre optics.
- 2) Principles of electrical charging.
- 3) Electrical symbols, units and terms.
- 4) Way in which transmission and chassis related electrical and electronic systems are
 - a) connected
 - b) dismantled
 - c) rectified
 - d) re-assembled
 - e) replaced.
- 5) Reasons why failure has occurred.
- 6) Recommendations based upon the inspection procedures
 - a) servicing
 - b) repair
 - c) replacing electrical components
 - d) repairing wiring and connectors.
- 7) How to select the most appropriate methods of diagnosis.
- 8) Rectifications within the transmission and chassis areas
 - a) electronic clutch control
 - b) electronic gearbox control system
 - c) electronic automatic gearbox control system
 - d) electric retarder systems
 - e) electronically controlled slip differential systems
 - f) electronic suspension control systems
 - g) ABS and traction control systems
 - h) electrical/electronic steering control systems
 - i) electronic stability control systems.
- 9) Interaction between electrical, electronic and mechanical components.
- 10) Engine, transmission and chassis electrical systems interlink, interact (including multiplexing).

- 11) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer.

Outcome 4

Describe the procedures for recording the results of rectification procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting diagnostic and rectification information.
- 2) Procedures for recording diagnostic and rectification activities
 - a) computer based
 - b) hard copy.
- 3) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 4) Procedures for
 - a) disposing of waste material resulting from the diagnostic and rectification activities
 - b) returning defective units and components to storage or for re-cycling.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLLA system. The test specification is as follows:

Outcome	Number of questions
1	6
2	9
3	7
4	3
Test duration 35mins	Total 25

Diagnose and Rectify Auxiliary Equipment Electrical Faults

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.

If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.

If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.

Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.



Information for VRQs (Technical Certificates).

To complete this unit you must:

Produce evidence of diagnosing and rectifying faults occurring in 3 of the 10 auxiliary equipment systems listed in the Scoping Statement.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.

Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ



Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently.
2. Produce evidence to show that you have covered all the items listed in the scope for this unit.
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace.
6. Simulated activities will be acceptable to assess candidates' diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

Specific Performance Evidence for this Unit

You must:

7. Produce evidence of diagnosing and rectifying faults occurring in at least 3 out of the 10* auxiliary equipment systems listed in the Scoping Statement. Your evidence must also include use of all the types of rectification activities listed in the Scoping Statement.

Of the 3 pieces of evidence produced, at least 2 must come from work in your normal workplace.

8. Your assessor must physically observe you in your normal workplace on at least 2 occasions, each observation covering the diagnosis and rectification of a fault in a different auxiliary equipment electrical system.

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

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.


Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ
SVQ



Evidence reference summary

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 1				
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 2				
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 3				

* Note the scoping statement requirements

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name: Candidate enrolment number: Candidate signature: Date:	N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name: Candidate enrolment number: Candidate signature: Date:
VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature: Date: Countersignature: (if relevant)..... Date:	N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature: Date: Countersignature: (if relevant)..... Date:
VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:	N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:

Performance objectives

You must be able to:	PRN
Wear suitable personal protective equipment and use vehicle coverings when using electrical testing techniques and carrying out rectification activities .	
Support the identification of electrical faults , by reviewing vehicle: <ul style="list-style-type: none"> • technical data • diagnostic test procedures. 	
Prepare, connect and test all the required electrical testing equipment following manufacturers' instructions prior to use.	
use electrical testing techniques which are relevant to the symptoms presented.	
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.	
Use the tools and equipment required, correctly and safely throughout all rectification activities.	
Carry out all rectification activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements. 	
Work in a way which minimises the risk of : <ul style="list-style-type: none"> • damage to other vehicle systems • damage to other components and units • contact with leakages • contact with hazardous substances. 	
Ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.	
When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.	
Ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.	
Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.	
Complete all system diagnostic activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical faults occurring within	
a. lighting systems	
b. wiper systems	
c. security and alarm systems	
d. comfort and convenience systems	
e. safety restraint systems (SRS)	
f. electric window systems	
g. sun roof systems	
h. audio systems	
i. visual systems	
j. navigation systems.	
2. Electrical and electronic testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
f. battery testing equipment	
h. dedicated and computer based diagnostic equipment.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical and electronic testing techniques are:	
a. voltage, resistance and current measuring	
b. frequency measuring	
c. visual	
d. dedicated and computer based testing.	
5. Rectification activities are:	
a. replacing electrical components	
b. repairing wiring and connectors.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.

Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying auxiliary equipment electrical faults. 2. Legal requirements relating to the vehicle electrics (including road safety and refrigerant handling requirements). 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - the referral of problems - reporting delays to the completion of work. 4. The importance of, documenting diagnostic and rectification information. 5. The importance of working to agreed timescales and keeping others informed of progress. 6. The relationship between time, costs and profitability. 7. The importance of reporting anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 8. Electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre optics principles. 9. Electrical symbols, units and terms. 10. Electrical safety procedures. 11. How auxiliary equipment electrical and electronic systems are constructed, dismantled and reassembled. 12. How auxiliary equipment electrical and electronic systems operate, including electrical component function, electrical inputs, outputs, voltages and patterns. 13. The interaction between electrical, electronic and mechanical components within the systems defined in scoping Statement 1 above. 14. How the auxiliary equipment electrical systems interlink and interact, including multiplexing. 	
<p>Use of electrical testing equipment</p> <ol style="list-style-type: none"> 15. How to prepare and test the accuracy of diagnostic testing equipment. 16. How to use electrical and electronic testing equipment. 	
<p>Auxiliary equipment electrical faults, their diagnosis and correction</p> <ol style="list-style-type: none"> 17. The types and causes of auxiliary equipment electrical system, component and unit faults and failures. 18. Auxiliary equipment electrical component and unit replacement procedures, the circumstances that will necessitate replacement and other possible courses of action. 19. How to find, interpret and use sources of information on auxiliary equipment electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements. 20. How to carry out systematic diagnostic testing of auxiliary equipment electrical and electronic systems using electrical testing techniques. 21. How to select the most appropriate diagnostic testing method for the symptoms presented. 22. How to interpret test results and vehicle data in order to identify the location and cause of vehicle system faults. 23. how to rectify electrical and electronic faults in electrical systems within the vehicle auxiliary equipment (i.e. lighting systems, wiper systems, security and alarm systems, comfort and convenience systems, safety restraint systems (SRS), electric window systems, run roof systems, audio systems, visual systems, navigation systems). 24. How to make suitable adjustments to components and units. 25. How to make cost effective recommendations for rectification. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.3; C2.2	Communication: Access 3, Outcomes 2 and 3 Intermediate 1, Outcome1
Application of Number: N2.1; N2.2; N2.3?	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: ICT1.1; ICT1.2; ICT1.3?	Information Technology: Access 3, Outcomes 1, 2 and 3?
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS3.1; PS3.2; PS3.3	Problem Solving: Intermediate 2, Outcomes 1, 2 and 3

Syllabus

Diagnose and Rectify Auxiliary Equipment Electrical Faults

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

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within vehicle auxiliary equipment.
2. Describe the types and causes of vehicle auxiliary equipment electrical faults and failures, and how to carry out systematic diagnostic testing of these systems and components.
3. Describe the procedures for rectifying electrical and electronic faults in vehicle auxiliary equipment.
4. Describe the procedures for recording the results of rectification procedures.

Outcome 1

Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within vehicle auxiliary electrical equipment.

Objectives

To achieve this outcome a student has to describe the

- 1) Preparation of the tools and equipment used for identifying and rectifying electrical faults occurring within auxiliary electrical equipment
 - a) hand tools
 - b) special purpose tools
 - c) general workshop equipment
 - d) voltmeters
 - e) ammeters
 - f) ohmmeters
 - g) multimeters
 - h) battery testing equipment
 - i) hand held diagnostic equipment
 - j) computer based diagnostic equipment
 - k) test lamps
 - l) oscilloscopes
 - m) logic probes.
- 2) Procedures for
 - a) preparing, connecting and testing all the required electrical diagnostic and testing equipment prior to use
 - b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
 - c) using the tools and equipment correctly and safely at all times.
- 3) Procedures used to obtain and check the data required for diagnosis.
- 4) Procedures for using the tools and equipment needed for diagnosis.

Outcome 2

Describe the types and causes of vehicle auxiliary equipment electrical faults and failures, and how to carry out systematic diagnostic testing of these systems and components.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic techniques used for fault diagnosis
 - a) voltage measurement
 - b) ohm and amp measurement
 - c) frequency measurement
 - d) visual
 - e) aural
 - f) dedicated and computer based.
- 2) Faults occurring in
 - a) lighting systems
 - b) wiper systems
 - c) security and alarm systems
 - d) heating systems
 - e) instrumentation / driver warning systems
 - f) comfort and convenience systems
 - g) safety restraint systems (SRS)
 - h) electric window and sun roof systems
 - i) audio systems
 - j) visual systems
 - k) navigation systems.
- 3) Methods of rectifying the faults listed above in paragraph 2 (a to i).
- 4) Methods of finding, interpreting and using information prior to diagnosis to ensure the systems and units will comply with
 - a) legal requirements
 - b) manufacturers specifications for
 - i. repair procedures
 - ii. limits, tolerances and fits.
- 5) Health and safety legislation and employers workshop practices relating to
 - a) personal protection
 - b) vehicle protection
 - c) recording fault location and rectification activities
 - d) referral of problems
 - e) reporting delays to the completion of work
 - f) importance of working to agreed timescales and keeping others informed of progress
 - g) relationship between time, costs and profitability
 - h) importance of reporting anticipated delays promptly.

- 6) Way in which auxiliary electrical and electronic systems operate including
 - a) electrical component function
 - b) electrical inputs
 - c) electrical outputs
 - d) voltages and patterns.

Outcome 3

Describe the procedures for rectifying electrical and electronic faults in vehicle auxiliary equipment.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic principles
 - a) Ohms law
 - b) voltage
 - c) power
 - d) current – (AC/DC)
 - e) resistance
 - f) magnetism, electromagnetism and electromagnetic induction
 - g) digital and fibre optics.
- 2) Electrical symbols, units and terms.
- 3) Way in which auxiliary electrical equipment systems are
 - a) constructed
 - b) dismantled
 - c) rectified
 - d) re-assembled
 - e) replaced.
- 4) Reasons why failure has occurred.
- 5) Recommendations based upon the inspection procedures
 - a) a servicing
 - b) b repair.
- 6) How to select the most appropriate methods of diagnosis.
- 7) Rectifications within the auxiliary electrical system areas
 - a) lighting systems
 - b) wiper systems
 - c) security and alarm systems
 - d) heating systems
 - e) instrumentation / driver warning systems
 - f) comfort and convenience systems
 - g) safety restraint systems (SRS)
 - h) electric window and sun roof systems
 - i) audio systems
 - j) visual systems
 - k) navigation systems.
- 8) Interaction between electrical, electronic and mechanical components.
- 9) Auxiliary electrical systems interlink, interact (including multiplexing).
- 10) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer.

Outcome 4

Describe the procedures for recording the results of rectification procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting diagnostic and rectification information.
- 2) Procedures for recording diagnostic and rectification activities
 - a) computer based
 - b) hard copy.
- 3) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 4) Procedures for
 - a) disposing of waste material resulting from the diagnostic and rectification activities
 - b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements.






Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

Outcome	Number of questions
1	6
2	9
3	7
4	3
Test duration 35mins	Total 25

Diagnose and Rectify Motorcycle Auxiliary Equipment Electrical Faults

 Further guidance available	 Observation of your task/work	 Evidence recording	 Computer based testing	 Verbal Questioning
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Evidence requirements

To complete this unit you will be required to undertake knowledge and practical tests.

For the knowledge test you must pass the City & Guilds computer based (GOLA) multiple choice knowledge test. This test will be arranged by your tutor or assessor.



If you are completing an apprenticeship which includes both N/SVQ & VRQ (Technical Certificate) you will only take this test once.

The practical tests will depend upon the qualification you are taking and are covered in the VRQ or NVQ information sections.

You must also complete the attached recording forms to the satisfaction of your assessor. These forms, when completed and signed by you and your assessor, provide confirmation that you have met both practical and knowledge requirements.



If you are undertaking an apprenticeship you need only complete one set which combines VRQ (Technical certificate) and N/SVQ evidence.



Your tutor or assessor will be able to offer you further guidance on the evidence you need to provide.

Information for VRQs (Technical Certificates).

To complete this unit you must:

Produce evidence of diagnosing and rectifying faults occurring in 3 of the 10 auxiliary equipment systems listed in the Scoping Statement.

Your tutor or assessor will either set or observe a practical assessment task, which has been designed to cover the performance objectives, or you may be observed by your assessor in your workplace. If this qualification forms part of an **apprenticeship** workplace observation will also provide N/SVQ evidence.



With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your tutor or assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.



All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.



Your assessor will ask questions to ensure you understand the practical task you are performing.

VRQ

Information for N/SVQs

General Requirements

You must:

1. Produce evidence to show you meet all of the performance objectives consistently
2. Produce evidence to show that you have covered all the items listed in the scope for this unit
3. Produce evidence to show that you possess all the knowledge required.
4. Produce performance evidence resulting from work you have carried out on real vehicles in your normal workplace or in a realistic working environment (RWE) as managed and organised by an approved centre when naturally occurring performance evidence does not occur at frequent intervals in your normal workplace or when safety is at risk.
5. Be observed by a qualified assessor carrying out work in your normal workplace
6. Simulated activities will be acceptable to assess candidates' diagnosis and rectification of faults which do not occur at frequent intervals on vehicles within the normal workplace or in the RWE environment, but which must be diagnosed and rectified to ensure that all the evidence requirements can be met.

Specific Performance Evidence for this Unit

You must:

7. Produce evidence of diagnosing and rectifying faults occurring in at least 3 out of the 10* auxiliary equipment systems listed in the Scoping Statement. Your evidence must also include use of all the types of rectification activities listed in the Scoping Statement.

Of the 3 pieces of evidence produced, at least 2 must come from work in your normal workplace.

8. Your assessor must physically observe you in your normal workplace on at least 2 occasions, each observation covering the diagnosis and rectification of a fault in a different auxiliary equipment electrical system.

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

With your assessor you must complete a suitable **City & Guilds evidence recording form** for **each** task. Your assessor will advise you on this. Other paperwork such as job cards, inspection sheets, servicing lists and reporting paperwork, appropriate to the task, should also be completed.

All work records/evidence should be numbered (portfolio reference number PRN) and entered where required on the recording forms. This evidence should be collected in a portfolio and may need to be made available to your internal verifier or the City & Guilds external verifier.


Your assessor will ask questions to ensure you understand the task you are performing.

If this qualification forms part of an **apprenticeship** workplace observation will also provide VRQ evidence.

NVQ
SVQ



Evidence reference summary (N/SVQ and VRQ)

	Note: Refer to the General and Specific Performance Evidence requirements for details of locations and types of assessment for this unit.	Portfolio reference number (PRN)		
		VRQ	N/SVQ	N/SVQ
		Observed assessment	Approved centre or workplace	Observed assessment
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 1				
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 2				
Diagnosis and rectification of a fault in an auxiliary equipment electrical system 3				

* Note the scoping statement and observation requirements

Supplementary evidence (if used) PRN			
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On line test reference for this unit PRN	
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Unit assessment and verification declaration

VRQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:	N/SVQ Candidate declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work Candidate name:..... Candidate enrolment number:..... Candidate signature:..... Date:
VRQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:	N/SVQ Assessor declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. Assessor name: Assessor signature:..... Date: Countersignature: (if relevant)..... Date:
VRQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:	N/SVQ Internal verifier Declaration: (Leave blank if sampling of this unit did not take place.) I have internally verified the assessment work on this unit in the following ways (please tick): <ul style="list-style-type: none"> • sampling candidate and assessment evidence • observation of assessment practice • discussion with candidate • other – please state: I confirm that the candidate's work meets the standards specified for this unit and may be presented for external verification and/or certification. Internal verifier name: Internal verifier signature: Date: Countersignature: (if relevant) Date:

Performance objectives

You must be able to:	PRN
Wear suitable personal protective equipment and use vehicle coverings when using electrical testing techniques and carrying out rectification activities .	
support the identification of electrical faults , by reviewing vehicle: <ul style="list-style-type: none"> • technical data • diagnostic test procedures. 	
Prepare, connect and test all the required electrical testing equipment following manufacturers' instructions prior to use.	
Use electrical testing techniques which are relevant to the symptoms presented.	
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.	
Use the tools and equipment required, correctly and safely throughout all rectification activities.	
Carry out all rectification activities following: <ul style="list-style-type: none"> • manufacturers' instructions • your workplace procedures • health and safety requirements. 	
Work in a way which minimises the risk of : <ul style="list-style-type: none"> • damage to other vehicle systems • damage to other components and units • contact with leakages • contact with hazardous substances. 	
Ensure all repaired and replaced electrical components and units conform to the vehicle operating specification and any legal requirements.	
When necessary, adjust components and units correctly to ensure that they operate to meet system requirements.	
Ensure the electrical system rectified performs to the vehicle operating specification and any legal requirements prior to return to the customer.	
Ensure your records are accurate, complete and passed to the relevant person(s) promptly in the format required.	
Complete all system diagnostic activities within the agreed timescale.	
Report any anticipated delays in completion to the relevant person(s) promptly.	

Scope of this unit

All of the items listed below form part of this National Occupational Standard.	PRN
1. Electrical faults occurring within	
a. lighting systems	
b. security and alarm systems.	
2. Electrical and electronic testing equipment covers:	
a. volt meters,	
b. ammeters,	
c. ohmmeters	
d. multimeters	
f. battery testing equipment	
h. dedicated and computer based diagnostic equipment.	
3. Tools and equipment:	
a. hand tools	
b. special purpose tools	
c. general workshop equipment.	
4. Electrical and electronic testing techniques are:	
a. voltage, resistance and current measuring	
b. frequency measuring	
c. visual	
d. dedicated and computer based testing.	
5. Rectification activities are:	
a. replacing electrical components	
b. repairing wiring and connectors.	

In signing this sheet the Assessor and Candidate confirm that all the objectives and scope statements were met at least once during the practical assessment tasks by the named candidate and that the safe working practices were observed at all times.	
Assessor	Date
Candidate	Date

Essential knowledge

You need to understand:	PRN
<p>Legislative and organisational requirements and procedures</p> <ol style="list-style-type: none"> 1. The health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing and rectifying auxiliary equipment electrical faults. 2. Legal requirements relating to the vehicle electrics (including road safety and refrigerant handling requirements). 3. Your workplace procedures for <ul style="list-style-type: none"> - recording fault location and rectification activities - the referral of problems - reporting delays to the completion of work 4. The importance of, documenting diagnostic and rectification information. 5. The importance of working to agreed timescales and keeping others informed of progress. 6. The relationship between time, costs and profitability. 7. The importance of reporting anticipated delays to the relevant person(s) promptly. 	
<p>Electrical and electronic principles</p> <ol style="list-style-type: none"> 8. Electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre optics principles. 9. Electrical symbols, units and terms. 10. Electrical safety procedures. 11. How auxiliary equipment electrical and electronic systems are constructed, dismantled and reassembled. 12. How auxiliary equipment electrical and electronic systems operate, including electrical component function, electrical inputs, outputs, voltages and patterns. 13. The interaction between electrical, electronic and mechanical components within the systems defined in Scoping Statement 1 above. 14. How the auxiliary equipment electrical systems interlink and interact, including multiplexing. 	
<p>Use of electrical testing equipment</p> <ol style="list-style-type: none"> 15. How to prepare and test the accuracy of diagnostic testing equipment. 16. How to use electrical and electronic testing equipment 	
<p>Auxiliary equipment electrical faults, their diagnosis and correction</p> <ol style="list-style-type: none"> 17. The types and causes of auxiliary equipment electrical system, component and unit faults and failures. 18. Auxiliary equipment electrical component and unit replacement procedures, the circumstances which will necessitate replacement and other possible courses of action. 19. How to find, interpret and use sources of information on auxiliary equipment electrical operating specifications, diagnostic test procedures, repair procedures and legal requirements. 20. How to carry out systematic diagnostic testing of auxiliary equipment electrical and electronic systems using electrical testing techniques. 21. How to select the most appropriate diagnostic testing method for the symptoms presented. 22. How to interpret test results and motor cycle data in order to identify the location and cause of motor cycle system faults. 23. How to rectify electrical and electronic faults in electrical systems within the motor cycle auxiliary equipment (i.e. lighting systems, security and alarm systems) 24. How to make suitable adjustments to components and units. 25. How to make cost effective recommendations for rectification. 	

In signing this sheet the Assessor and Candidate confirm that all the essential knowledge has been met by the named candidate.	
Assessor	Date
Candidate	Date

Key and core skills signposting

Key Skills	Core Skills
Communication: C1.1; C1.3; C2.2	Communication: Access 3, Outcomes 2 and 3 Intermediate 1, Outcome1
Application of Number: N2.1; N2.2; N2.3?	Numeracy: Intermediate 1, Outcomes 1, 2 and 4
Information Technology: ICT1.1; ICT1.2; ICT1.3?	Information Technology: Access 3, Outcomes 1, 2 and 3?
Working with Others: WO2.2	Working with Others: Intermediate 1, Outcome 2
Improving Own Learning and Performance: Not applicable	<i>No parallel unit.</i>
Problem Solving: PS3.1; PS3.2; PS3.3	Problem Solving: Intermediate 2, Outcomes 1, 2 and 3

Syllabus

Diagnose and Rectify Motorcycle Auxiliary Equipment Electrical Faults

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

Course Outline

To assist Centres in developing training courses, further guidance is given relating to the NVQ essential knowledge statements. The outline syllabus is a requirement for Technical Certificate courses. This is presented as a number of outcomes that in turn each have a number of objectives and expanded content detail.

Reference should also be made to the National Standards.

Outcomes

On completion of this unit, the student must be able to:

1. Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within motorcycle auxiliary equipment.
2. Describe the types and causes of vehicle auxiliary equipment electrical faults and failures, and how to carry out systematic diagnostic testing of these systems and components.
3. Describe the procedures for rectifying electrical and electronic faults in motorcycle auxiliary equipment.
4. Describe the procedures for recording the results of rectification procedures.

Outcome 1

Describe the procedures for preparing tools and equipment and data sources required for identifying and rectifying electrical faults occurring within vehicle auxiliary electrical equipment.

Objectives

To achieve this outcome a student has to describe the

- 1) Preparation of the tools and equipment used for identifying and rectifying electrical faults occurring within auxiliary electrical equipment
 - a) hand tools
 - b) special purpose tools
 - c) general workshop equipment
 - d) voltmeters
 - e) ammeters
 - f) ohmmeters
 - g) multimeters
 - h) battery testing equipment
 - i) hand held diagnostic equipment
 - j) computer based diagnostic equipment
 - k) test lamps
 - l) oscilloscopes
 - m) logic probes.
- 2) Procedures for
 - a) preparing, connecting and testing all the required electrical diagnostic and testing equipment prior to use
 - b) systematic collection of sufficient diagnostic information to enable precise identification of the fault
 - c) using the tools and equipment correctly and safely at all times.
- 3) Procedures used to obtain and check the data required for diagnosis.
- 4) Procedures for using the tools and equipment needed for diagnosis.

Outcome 2

Describe the types and causes of vehicle auxiliary equipment electrical faults and failures, and how to carry out systematic diagnostic testing of these systems and components.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic techniques used for fault diagnosis
 - a) voltage measurement
 - b) ohm and amp measurement
 - c) frequency measurement
 - d) visual
 - e) aural
 - f) dedicated and computer based
- 2) Faults occurring in
 - a) lighting systems
 - b) security and alarm systems
- 3) Methods of rectifying the faults listed above in paragraph 2 (a to i)
- 4) Methods of finding, interpreting and using information prior to diagnosis to ensure the systems and units will comply with
 - a) legal requirements
 - b) manufacturers specifications for
 - i. repair procedures
 - ii. limits, tolerances and fits
- 5) Health and safety legislation and employers workshop practices relating to
 - a) personal protection
 - b) vehicle protection
 - c) recording fault location and rectification activities
 - d) referral of problems
 - e) reporting delays to the completion of work
 - f) importance of working to agreed timescales and keeping others informed of progress
 - g) relationship between time, costs and profitability
 - h) importance of reporting anticipated delays promptly.
- 6) Way in which auxiliary electrical and electronic systems operate including
 - a) electrical component function
 - b) electrical inputs
 - c) electrical outputs
 - d) voltages and patterns.

Outcome 3

Describe the procedures for rectifying electrical and electronic faults in vehicle auxiliary equipment.

Objectives

To achieve this outcome a student has to describe the:

- 1) Electrical and electronic principles
 - a) Ohms law
 - b) voltage
 - c) power
 - d) current – (AC/DC)
 - e) resistance
 - f) magnetism, electromagnetism and electromagnetic induction
 - g) digital and fibre optics.
- 2) Electrical symbols, units and terms.
- 3) Way in which auxiliary electrical equipment systems are
 - a) constructed
 - b) dismantled
 - c) rectified
 - d) re-assembled
 - e) replaced
- 4) Reasons why failure has occurred.
- 5) Recommendations based upon the inspection procedures
 - a) servicing
 - b) repair.
- 6) How to select the most appropriate methods of diagnosis.
- 7) Rectifications within the auxiliary electrical system areas
 - a) lighting systems
 - b) security and alarm systems.
- 8) Interaction between electrical, electronic and mechanical components.
- 9) Auxiliary electrical systems interlink, interact (including multiplexing).
- 10) Way in which the systems are evaluated to ensure they comply with manufacturers and legal requirements prior to return to the customer.

Outcome 4

Describe the procedures for recording the results of rectification procedures.

Objectives

To achieve this outcome a student has to describe the:

- 1) Importance of documenting diagnostic and rectification information.
- 2) Procedures for recording diagnostic and rectification activities
 - a) computer based
 - b) hard copy.
- 3) Importance of ensuring the records are
 - a) accurate
 - b) complete
 - c) in the format required
 - d) passed promptly to the relevant person.
- 4) Procedures for
 - a) disposing of waste material resulting from the diagnostic and rectification activities
 - b) returning defective units and components to storage or for re-cycling, including refrigerant handling requirements.

Assessment

Essential knowledge assessment

Essential knowledge will be assessed using the GOLA system. The test specification is as follows:

Outcome	Number of questions
1	6
2	9
3	7
4	3
Test duration 35mins	Total 25