

National Unit Specification: general information

UNIT Automotive: Electrical/Electronic Systems (Higher)

NUMBER D23B 12

COURSE

SUMMARY

A unit designed to develop knowledge of the electrical/electronic systems fitted to a vehicle and the operation of the main components within the system, and how to deliver constructive reasoning/interpretation of the faults from an identified symptom.

OUTCOMES

- 1 Explain the operation of the electrical/electronic system main components.
- 2 Identify for given electrical/electronic system symptoms the possible fault(s).
- 3 Demonstrate the procedure for testing electrical/electronic components and evaluate the test results.

RECOMMENDED ENTRY

Access to this unit is at the discretion of the centre. However, it would be beneficial if the candidate had achieved the unit Automotive: Introduction to Vehicle Electrical/Electronic Systems (Intermediate 2) (2210248).

CREDIT VALUE

1 credit at Higher.

CORE SKILLS

Information on the automatic certification of any core skills in this unit is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

Administrative Information

Superclass: XR

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National Unit Specification: statement of standards

UNIT Automotive: Electrical/Electronic Systems (Higher)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Explain the operation of the electrical/electronic system main components.

Performance criteria

- a) The explanation of the battery operation is correct.
- b) The explanation of the alternator operation is correct.
- c) The explanation of the starter motor operation is correct.
- d) The explanation of the electronic signalling flasher unit operation is correct.

Note on range for the outcome

Lead acid battery: capacity; chemical action; charge and discharge process.

Alternator: star or delta wound; field excitation; regulation; rectification; surge protection.

Starter: pre-engaged.

Lighting: obligatory requirements; indicator pulse rate.

Evidence requirements

Please refer to *Evidence requirements for the unit* at the end of the Statement of Standards.

OUTCOME 2

Identify for given electrical/electronic system symptoms the possible fault(s).

Performance criteria

- a) Correctly identify for a given symptom, battery faults.
- b) Correctly identify for a given symptom, alternator faults.
- c) Correctly identify for a given symptom, starter motor faults.
- d) Correctly identify for a given symptom, lighting/signalling faults.

Note on Range for Outcome

Symptoms:

Battery: will not hold charge; holds a charge for a few days only; will not take a charge.

Alternator: warning light fails to come on; warning light remains illuminated with engine running; warning lights remain illuminated with the ignition key removed.

Starter: starter "clicks" when attempting to start but does not turn; when the ignition key is turned there is no response from the starter and the dash lights remain unaffected.

National Unit Specification: statement of standards (cont)

UNIT Automotive: Electrical/Electronic Systems (Higher)

Lighting: one headlamp much dimmer than the other; light spread from headlamps but no defined pattern; indicators pulse at a rate higher than 120 per minute.

Evidence requirements

Please refer to *Evidence requirements for the unit* at the end of the Statement of Standards.

OUTCOME 3

Demonstrate the procedure for testing electrical/electronic components and evaluate the test results.

Performance criteria

- a) Correctly demonstrate the procedure to test a battery.
- b) Correctly demonstrate the procedure to test an alternator.
- c) Correctly demonstrate the procedure to test a starter motor.
- d) Correctly demonstrate the procedure to test a lighting/signalling system.
- e) Correctly evaluate for components in PC (a) (b) (c) and (d), the results of the tests against manufacturers' specification.

Note on Range for Outcome

Tests:

Battery: high rate discharge; terminal voltage; cranking voltage.

Alternator: drive belt tension; cable continuity; maximum output; voltage drop; regulator voltage.

Starter: cranking current; voltage drop.

Lighting: headlamp alignment; volt drop; visual.

Evidence requirements

Please refer to *Evidence requirements for the unit* at the end of the Statement of Standards.

EVIDENCE REQUIREMENTS FOR THE UNIT

Outcome 1

Written and/or oral evidence of the candidate's ability to correctly explain the operation of electrical/electronic system main components.

Satisfactory achievement of the outcomes will be based on all performance criteria being met.

National Unit Specification: statement of standards (cont)

UNIT Automotive: Electrical/Electronic Systems (Higher)

This will be demonstrated by the candidate producing:

- PC (a) correct explanation of the chemical action within the battery during charge and discharge;
- PC (b) correct explanation of the operation of 2 main alternator components;
- PC (c) correct explanation of the operation of the starter motor;
- PC (d) correct explanation of the operation of an electronic signalling flasher unit.

Outcome 2

Written and/or oral evidence of the candidate's ability to correctly identify the fault(s) for the given symptoms of the electrical/electronic system.

Satisfactory achievement of the outcome will be based on all performance criteria being met.

This will be demonstrated by the candidate producing:

- PC (a) correct identification of a possible battery fault for 2 given symptoms;
- PC (b) correct identification of a possible alternator fault for 2 given symptoms;
- PC (c) correct identification of a possible starter fault for 2 given symptoms;
- PC (d) correct identification of a possible lighting/signalling fault for 2 given symptoms.

Outcome 3

Practical evidence of the candidate's ability to correctly demonstrate the procedure for testing electrical components and evaluate the test results.

Satisfactory achievement of the outcome will be based on all performance criteria being met.

This will be demonstrated by the candidate's ability to:

- PC (a) correctly carry out the battery test procedures;
- PC (b) correctly carry out the alternator test procedures;
- PC (c) correctly carry out the starter motor test procedures;
- PC (d) correctly carry out the lighting/signalling system test procedures;
- PC (e) correctly evaluate the test results against test specifications.

National Unit Specification: support notes

UNIT Automotive: Electrical/Electronic Systems (Higher)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The candidate successfully completing this unit will acquire skills and knowledge relating to the operation of automotive electrical system main components, the symptoms experienced when the units are not operating to the specifications, the likely faults that can produce the symptoms and the ability to carry out system and component tests which will assist in the diagnosis of the faults.

The unit is intended primarily for candidates who have a knowledge of electrical/electronic systems up to Intermediate 2 level and, who wish to attain the ability to test and diagnose both system and component faults.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Relating to Outcomes 1, 2 & 3

Candidates could be given the opportunity to examine, in a practical location, manual electrical/electronic systems, to identify the relationships of the main components to each other. The operation of the electrical/electronic system components could be demonstrated in a practical situation/location with video and other aids used as reinforcement.

Workshop manuals, diagnostic equipment, special tools required for the removal/replacement, setting and testing of components should be available to the candidates.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

Written/graphical exercise.

Outcome 2

Written/graphical exercise.

Outcome 3

Direct observation in conjunction with specified criteria for the given task.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).