Higher National Unit specification

General information for centres

Unit title: Automotive Engineering: Diagnostics

Unit code: F53W 34

Unit purpose: This Unit enables candidates to gain competence in using and interpreting a range of electrical and electronic test equipment. This is a practically focussed Unit and it is aimed at those with little previous knowledge of automotive electrical/electronic systems. The practical aspects and necessary equipment require that this Unit is delivered in a workshop environment.

On completion of the Unit the candidate should be able to:

1 Diagnose electrical and electronic driver information systems.
2 Diagnose systems using electrical/electronic diagnostic equipment.
3 Diagnose sensors within systems, using electrical/electronic diagnostic equipment.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. However, it would be beneficial if candidates had prior knowledge and experience of basic electrical and electronic systems for example at SVQ level 3 or equivalent. This could also be evidenced by possession of the HN Unit *Automotive Engineering: Electrical and Electronic Principles and Ancillary Systems*, or equivalent.

Core Skills: There are opportunities to develop the Core Skills of *Problem Solving*, *Working with Others*, and *Numeracy* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes. This Unit was developed for the Automotive Engineering HNC/HND. It is strongly recommended that this Unit is integrated in its delivery and assessment with other pertinent Units from the Automotive Engineering frameworks.

Assessment: Outcomes 1, 2 and 3 should be delivered in an automotive workshop with sufficient vehicles or systems which enable candidates to carry out the required practical diagnostic tests. It is very important that the relevant data/procedures are available to enable candidates to acquire the salient test procedures. Candidates should be given the opportunity to complete assessment at appropriate points. It is recommended that the Unit be assessed on an ongoing basis using suitable checklists to assist in recording evidence along with a printout of the test results.

Higher National Unit specification: statement of standards

Unit title: Automotive Engineering: Diagnostics

Unit code: F53W 34

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Diagnose electrical and electronic driver information systems

Knowledge and/or Skills

- Electrical meters (voltmeters, ammeters, ohmmeters)
- Technical data
- Systems diagnosis
- Electrical and electronic driver information systems (charging, starting, diesel pre-start, diesel post-start)
- Health and safety procedures

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- demonstrate the correct use of an electrical meter. Candidates must identify one fault in each of the systems given in the Knowledge and Skills. Each of the following faults must be covered: open circuit, short circuit and high resistance. Candidates must use a voltmeter, ammeter, and ohmmeter.
- demonstrate the correct use of technical data for electrical and electronic driver information systems diagnosis. Candidates must use given technical data for the diagnosis of each of the systems given in the Knowledge and Skills. Candidates must test and diagnose the systems by connecting electrical meters (voltmeter, ammeter, and ohmmeter) and interpreting the readings obtained to identify the fault in each system. This must include electrical and electronic driver information systems (charging, starting, diesel pre-start, diesel post-start).
- apply appropriate health and safety procedures.

Assessment Guidelines

Checklists could be used to assist in recording evidence, alongside printouts of the test results. A multimeter could be used rather than separate voltmeters, ammeters, and ohmmeters.

Higher National Unit specification: statement of standards (cont)

Unit title: Automotive Engineering: Diagnostics

Outcome 2

Diagnose systems using electrical/electronic diagnostic equipment

Knowledge and/or Skills

- Electrical/electronic test equipment
- Technical data
- Systems diagnosis
- ABS and associated braking systems
- Engine Management Systems
  - Electronic ignition systems
  - Fuel management systems
- Health and safety procedures

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- demonstrate the correct use of an oscilloscope. Candidates must identify one fault in each of the systems given in the Knowledge and Skills. Each of the following faults must be covered: open circuit, short circuit and high resistance.
- demonstrate the use of technical data for systems diagnosis. Candidates must use given technical data for the diagnosis of each of the systems given in the Knowledge and Skills. Candidates must test and diagnose the systems by connecting an oscilloscope and interpreting readings obtained, to identify the fault in each.
- apply appropriate health and safety procedures.

Assessment Guidelines

Checklists could be used to assist in recording evidence, alongside printouts of the test results. Faults to be tested for could include incorrect waveform, pattern or readings. Technical data which can be used in this Outcome include manufacturer's specifications, flow charts, etc.

Higher National Unit specification: statement of standards (cont)

Unit title: Automotive Engineering: Diagnostics

Outcome 3

Diagnose sensors within systems, using electrical/electronic diagnostic equipment

Knowledge and/or Skills

- Sensors
- Technical data
- Systems diagnosis
- Health and safety procedures

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- demonstrate the correct use of electrical/electronic diagnostic equipment in the diagnosis of sensors. Using given technical data, candidates must test and diagnose four different sensors and compare results against manufacturer's specifications. Systems to be tested must include ABS, engine management systems and air conditioning.
- apply appropriate health and safety procedures.

Assessment Guidelines

Electrical/electronic diagnostic equipment could include a sensor simulator, oscilloscope, ohmmeter. Checklists could be used to assist in recording evidence, alongside printouts of the test results.

Administrative Information

Unit code: F53W 34

Unit title: Automotive Engineering: Diagnostics

Superclass category: XR

Original date of publication: August 2008

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Automotive Engineering: Diagnostics

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

Candidates should achieve the level of understanding equivalent to the level of a diagnostic technician in the automotive industry, being required to diagnose electrical/electronic system faults on vehicles.

Where candidates are asked to apply appropriate health and safety procedures, these will relate to the practical element of the particular Outcome.

Outcomes 1, 2 and 3 should be delivered in an automotive workshop that has sufficient vehicles or systems that enable candidates to carry out the required practical diagnostic tests. It is very important that the relevant data/procedures are available to enable candidates to acquire the salient test procedures. It is strongly recommended that this Unit is integrated in its delivery and assessment with other pertinent Units from the Automotive Engineering HNC.

In Outcomes 1 and 2, where demonstrating the correct use of technical data for systems diagnosis, this may take the form of, for example, a flow chart, software program, or procedures list.

Where asked to identify and record a system fault, these could include any general faults such as in sensors, inductive sensors, wiring, high resistance, open circuit, etc.

Guidance on the delivery and assessment of this Unit

It is strongly recommended that this Unit is delivered and assessed with other Units in the Automotive Engineering HNC. Depending on the delivering centre's resources and specialisms, the most appropriate Units for integration could vary. Potential Units, however, would include *Automotive: Engine Management Systems*, *Automotive: Electrical/Electronic Systems* and *Automotive: Braking Systems*.

As the emphasis of this Unit is a practical mastery of the use of diagnostic equipment, the most appropriate instrument of assessment would be a practical exercise.

Examples of additional test equipment that could be used in Outcome 2 are as follows: exhaust gas analyser, interactive service diagnostic equipment and serial/parallel data links.

Opportunities for developing Core Skills

The delivery and assessment of this Unit may offer opportunities to develop the Core Skill of *Problem Solving* at SCQF level 5. Its three components Critical Thinking, Planning and Organising and Reviewing and Evaluating require candidates to be able to:

- analyse a situation or issue
- plan, organise and complete a task
- review and evaluate a problem solving activity

Higher National Unit specification: support notes (cont)

These skills may be used across all three Outcomes in which candidates need to use equipment to gain information and arrive at a conclusion (diagnosis). Candidates could be asked to plan their activity and to review the success of their problem solving strategy upon completion of the task.

This Unit offers opportunities to develop the Core Skill of *Working with Others* at SCQF level 5, the general skill of which is to 'work with others in a group to analyse, plan and complete and activity,' through group activity. Specific skills required at SCQF level 5 include analysing the activity and identifying component tasks and roles, agreeing responsibilities and supporting co-operative working. Candidates may require to use these skills when planning and carrying out the testing of diagnostic systems, and following health and safety procedures. For these activities to be successful, candidates will need to collaborate effectively, particularly to resolve any practical problems or obstacles that arise.

The delivery and assessment of this Unit may contribute towards development of the Core Skill of *Numeracy* at SCQF level 5. The component Using Number may be developed during the diagnosis of the various relevant automotive systems when dealing with recording and analysis of numerical data. The general skill for this component is 'apply a wide range of numerical skills in everyday and generalised contexts.' In so doing, candidates may need to perform the component's specific skills as follows:

- work confidently with a numerical concept
- decide on the numerical operations to be carried out
- carry out complex calculations or a number of sustained calculations

The general skill required by the component Using Graphical Information is the ability to 'interpret and communicate graphical information in everyday and generalised contexts'. Specific skills include the interpretation of information from tables, graphs, etc and communication of information by appropriately incorporating such tables and graphs. Again, candidates may meet these criteria where dealing with data collected during the process of diagnosing automotive systems, the results of which candidates may illustrate via tables, graphs, etc.

Open learning

This Unit could be delivered by distance learning. However, it would require planning by the centre to ensure the sufficiency and authenticity of candidate evidence. Completion of this Unit would also require access to specialised equipment. The practical aspects and equipment required (it should be delivered in a workshop environment) may engender some difficulties in delivering via Open Learning.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

General information for candidates

Unit title: Automotive Engineering: Diagnostics

This Unit will enable you to use and interpret a range of electrical and electronic test equipment. This is a practically focussed Unit which will provide you with the level of understanding necessary to diagnose electrical/electronic system faults on vehicles. It is especially suitable for work as a diagnostic technician in the automotive engineering industry. This is a single credit Unit at SCQF level 7.

On completion of the Unit you should be able to:

1 Diagnose electrical and electronic driver information systems.
2 Diagnose systems using electrical/electronic diagnostic equipment.
3 Diagnose sensors within systems, using electrical/electronic diagnostic equipment.

In Outcome 1, you will learn about the usage of different electrical meters, and how to diagnose faults with the aid of technical data.

In Outcome 2 you will use an oscilloscope and dedicated electrical/electronic diagnostic equipment and interpret readings to determine systems serviceability.

In Outcome 3 you will diagnose and record sensor serviceability using electrical/electronic diagnostic equipment.

Throughout the Unit, you will need to follow appropriate health and safety procedures in any practical work undertaken.

In this Unit you will be assessed by your completion of practical exercises, under the observation of your tutor.

In undertaking this Unit there may be opportunities for you to develop Core Skills in the areas of *Problem Solving*, *Working with Others* and *Numeracy*.