



Higher National Unit specification

General information for centres

Unit title: Automotive Engineering: Steering and Suspension Systems

Unit code: F541 34

Unit purpose: This Unit will provide candidates with knowledge and understanding of advanced automotive steering and suspension systems. The Unit also introduces candidates to the concept of systems interaction. The Unit is intended for candidates who have existing electrical and hydraulic knowledge and are familiar with how these systems are managed and operated.

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

- 1 Explain the main function and operation of an electronic power assisted steering system and apply diagnostic test procedures.
- 2 Explain the principle of operation of an electronic adaptive/active suspension system and apply diagnostic test procedures.

Credit points and level: 2 HN credits at SCQF level 7: (16 SCQF credit points at SCQF level 8*)

**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: While entry to this Unit will be at the discretion of the centre, it is recommended that the candidates have prior knowledge of Vehicle Electrical systems, for example at SVQ level 3 or equivalent. It is also recommended that candidates have first completed or are working towards the HN Unit *Electrical and Electronic Principles and Ancillary Systems*.

Core Skills: There are opportunities to develop the Core Skills of *Communication* and *Problem Solving* 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.

Assessment: The Unit could be assessed in various ways. The Unit could be assessed by a combination of extended response and practical exercises. It is recommended that each part of the Unit be assessed on an ongoing basis. A report of approximately 500 words in length or equivalent per Outcome could act as a guide for the sufficiency of evidence. Outcomes 1 and 2 could be integrated, or each Outcome could be assessed individually. If integrated, a combined report could be approximately 750 words, or equivalent, in length.

Higher National Unit specification: statement of standards

Unit title: Automotive Engineering: Steering and Suspension Systems

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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

Explain the main function and operation of an electronic power assisted steering system and apply diagnostic test procedures.

Knowledge and/or Skills

- ◆ System operation
- ◆ Component construction and operation
- ◆ Diagnostic test procedures
- ◆ Health and safety procedures

Evidence Requirements

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

- ◆ explain the operation of an electronic power assisted steering system, including all control modules, sensors and actuators
- ◆ for the system explained, identify the sensor type and describe the sensor operation, actuator operation, fluid flow (where required) and Electronic Control Unit (ECU) operation in all modes (this must cover input, decode, process, output)
- ◆ explain in detail the provision for a system failsafe operation
- ◆ apply diagnostic test procedures to a power assisted steering system to determine the serviceability
- ◆ identify and record a system fault using diagnostic test equipment
- ◆ apply appropriate health and safety procedures

Assessment Guidelines

This Outcome could be assessed by a report of approximately 500 words in length or equivalent, and a practical task with the aid of an observation checklist. The candidate will also be assessed during a practical workshop task, with the aid of an observation checklist. While candidates must explain the operation of one steering system, it is strongly recommended that all up to date systems are taught (eg Electronic, Electro/Hydraulic **and** Hydraulic). Candidates may, for example, explain one system, and carry out diagnostic test procedures on another. Outcomes 1 and 2 could be integrated.

Higher National Unit specification: statement of standards (cont)

Unit title: Automotive Engineering: Steering and Suspension Systems

Outcome 2

Explain the principle of operation of an electronic adaptive/active suspension system and apply diagnostic test procedures

Knowledge and/or Skills

- ◆ System operation
- ◆ Component construction and operation
- ◆ Systems interaction
- ◆ Diagnostic test procedures
- ◆ Health and safety procedures

Evidence Requirements

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

- ◆ explain the operation of an electronic adaptive/active suspension system, detailing the function and design.
- ◆ for the system explained, identify the sensor type and describe the sensor operation, hydraulic operation (where required) and Electronic Control Unit (ECU) operating conditions (this must cover input, decode, process, output).
- ◆ explain the interaction and communication between the systems' Electronic Control Units (ECU) from Outcome 1 and that of Outcome 2.
- ◆ describe in detail the provision for a system failsafe operation.
- ◆ apply diagnostic test procedures to electronic adaptive/active suspension system to determine their serviceability.
- ◆ identify and record a system fault using dedicated diagnostic test equipment. This must be tested on a car with an electronic adaptive/active suspension system.
- ◆ apply appropriate health and safety procedures.

Assessment Guidelines

Outcomes 1 and 2 could be integrated. This Outcome could be assessed by a report of approximately 500 words in length or equivalent. The candidate will also be assessed during a practical workshop task, with the aid of an observation checklist or test plan.

Administrative Information

Unit code: F541 34

Unit title: Automotive Engineering: Steering and Suspension Systems

Superclass category: XR

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Higher National Unit specification: support notes

Unit title: Automotive Engineering: Steering and Suspension Systems

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 80 hours.

Guidance on the content and context for this Unit

Candidates should achieve the level of competence required of someone who is able to determine the operating characteristics and evaluate the operation and application of advanced steering and suspension systems. The Unit should be taught in the context of light vehicle applications.

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

Outcome 1

This Outcome gives a broad introduction to the operation and functions of a vehicle's power assisted steering system and components. Candidates should also be able to understand the interaction of different vehicle systems. Various system tests and procedures using diagnostic test equipment and a record of the findings should also be included.

While candidates must explain the operation of one steering system, it is strongly recommended that all up to date systems are taught (eg electronic, electro/hydraulic **and** hydraulic). Candidates could, for example, explain one system, and carry out diagnostic test procedures on another.

Outcome 2

This Outcome introduces the candidate to vehicle active/adaptive suspension systems and how they can affect a vehicle's road handling. Candidates should also be able to understand the interaction of different vehicle systems. Various system tests and procedures using diagnostic test equipment and a record of the findings should also be included.

The practical elements of Outcomes 1 and 2 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.

Where asked to explain the interaction and communication of a vehicle's various Electronic Control Units (ECU), this could include engine management, braking systems, electronic gearbox control, and electronic steering control.

Guidance on the delivery and assessment of this Unit

Although this Unit is a free-standing Unit, it is strongly recommended that it is delivered and assessed with other Units in the Automotive Engineering HNC framework. It is recommended that where possible, an integrative approach should be taken when completing the assessments within a Group Award.

This integrative approach may be demonstrated with this Unit by integrating it with *Automotive Engineering: Braking Systems and Vehicle Stability Control*.

Higher National Unit specification: support notes (cont)

Unit title: Automotive Engineering: Steering and Suspension Systems

Opportunities for developing Core Skills

The delivery and assessment of this Unit may contribute towards the Core Skill of *Communication* at SCQF level 5.

The general skills of the Written Communication component are ‘read, understand and evaluate written communication’ for its reading Element and ‘produce well-structured written communication’ for its written Element. Specific reading skills required by candidates at SCQF level 5 include identifying and summarising significant information, ideas and supporting details in a written communication, and evaluation of the effectiveness of the communication in meeting its purpose; and specific writing skills include ‘presenting all essential ideas, information and supporting detail in a logical and effective order, and use of a structure which takes account of purpose and audience, emphasising the main points.

Candidates may need to utilise these skills in such tasks as explaining the main function and operation of a power assisted steering system in Outcome 1 and the interaction and communication between the Electronic Control Units in Outcome 2. Candidates may be asked to produce an extended response on these and related topics, of around 1,000 words in total, which would allow for development of Communication.

Depending on assessment instruments used, candidates may develop the Oral Communication component to SCQF level 5, if for example, delivering an oral presentation or leading discussion on any of these topics.

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

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.

These skills may be used during the practical aspects of both Outcomes which may require the planning of test procedures. Candidates will need to use specialised equipment to gather and record information, with which they will identify and record system faults. Candidates could be asked to plan their activity and to review the success of their problem solving strategy upon completion of the task.

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.

Higher National Unit specification: support notes (cont)

Unit title: Automotive Engineering: Steering and Suspension Systems

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

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This Unit will provide you with knowledge and understanding of automotive steering and suspension systems. The Unit also introduces the concept of systems interaction. The Unit is intended for candidates who have existing electrical and hydraulic knowledge and are familiar with how these systems are managed and operated.

On completion of the Unit you should be able to:

- 1 Explain the main function and operation of an electronic power assisted steering system and apply diagnostic test procedures.
- 2 Explain the principle of operation of an electronic adaptive/active suspension system and apply diagnostic test procedures.

This Unit will allow you to achieve the level of competence required to determine the operating characteristics and evaluate the operation and application of advanced power steering and active/adaptive suspension systems.

Outcomes 1 and 2

Outcomes 1 and 2 will give you a broad introduction to the operation and functions of power assisted steering systems and adaptive/active suspension systems and will develop understanding of the interaction of different vehicle systems.

The practical elements of this Unit will be delivered in an automotive workshop, enabling you to carry out the required practical diagnostic tests, in order to determine the serviceability of the systems.

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