



Higher National Unit specification

General information for centres

Unit title: Automotive Engineering: Engine Technology

Unit code: F540 34

Unit purpose: This Unit will give candidates the technical knowledge to appreciate the developments and requirements of automotive engines, and explain the operational requirements and applications of automotive engines used in road vehicles.

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

- 1 Explain how combustion technology influences cylinder combustion efficiency.
- 2 Explain the construction and operation of one variable valve timing layout.

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 engine technology at SVQ level 3 or equivalent.

Core Skills: There are opportunities to develop the Core Skill of *Communication* 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: Outcomes 1 and 2 may be assessed by extended responses.

Higher National Unit specification: statement of standards

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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 how combustion technology influences cylinder combustion efficiency

Knowledge and/or Skills

- ◆ Combustion technology:
 - Cylinder head design
 - Engine torque
 - Engine power
 - Fuel consumption

Evidence Requirements

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

- ◆ explain how combustion technology influences cylinder combustion efficiency. Explanations must cover the following:
 - cylinder head design, to include: induction charge and exhaust discharge over a speed range; swirl; turbulence; squish; flame propagation; multi valve layouts, direct and indirect injection
 - engine torque, to include: compression ratio; air fuel mixture ratio
 - engine power, to include: compression ratio; air fuel mixture ratio
 - fuel consumption, to include: lean burn; homogeneous mixture, stratified mixture, atmospheric pollution; exhaust pollutants, stoichiometric ratio

Assessment Guidelines

This could be demonstrated by a candidate producing a report or extended response of approximately 750 words or equivalent for Outcome 1. Outcomes 1 and 2 could also be assessed by an integrated report of approximately 1,000 words or equivalent.

Higher National Unit specification: statement of standards (cont)

Unit title: Automotive Engineering: Engine Technology

Outcome 2

Explain the construction and operation of one variable valve timing layout

Knowledge and/or Skills

- ◆ Engine variable valve timing principles
- ◆ Engine variable valve timing layout, construction and operation, including sensors and actuators, performance and emissions

Evidence Requirements

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

- ◆ explain the principles of operation of one variable valve timing layout and its effect on the performance and emissions for an engine
- ◆ explain, with the aid of a diagram, the layout, construction and operation of one variable valve timing layout, including all sensors and actuators

Assessment Guidelines

This could be demonstrated by a candidate producing a report or extended response of approximately 750 words, or equivalent for Outcome 2. Outcomes 1 and 2 could also be assessed by an integrated report of approximately 1,000 words or equivalent.

Administrative Information

Unit code: F540 34

Unit title: Automotive Engineering: Engine Technology

Superclass category: XR

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Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Automotive Engineering: Engine Technology

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

This Unit is a theoretical Unit, written for the framework of the Automotive Engineering HNC. It may also be delivered on a standalone basis.

The principles of operation covered in this Unit are likely to apply to a number of vehicle manufacturers' engine design, as used to enhance performance characteristics of the vehicle and reduce emissions which are detrimental to the environment. It may be useful, therefore, to consider these principles within the context of current EU emission legislation.

In Outcome 1, it is strongly recommended that both spark ignition or compression ignition engine technologies are taught.

Where candidates are asked to produce diagrams to show current engine technology, these should be sourced, for example, from manufacturer's information, manuals, etc. There is no requirement to draw a detailed diagram from scratch.

Guidance on the delivery and assessment of this Unit

Outcome 1 could be assessed by the use of a case study. Assessment of Outcomes 1 and 2 could also be integrated, and assessed by a combined report.

In Outcome 2, when looking at the engine variable valve timing construction, operation and location, it may be useful to cover the Electronic Control Unit, if applicable. If covering the ECU, this should give a broad overview of the ECU's general operation within the system, without going into major depth of the ECU's internal components. More complex explanation of the general operation of the ECU components could be covered at SCQF level 8.

When looking at continuous variable valve timing control, chosen engines could include, for example:

- ◆ BMW single and double vanos
- ◆ Honda V-Tech
- ◆ Nissan Continuously Variable Valve Timing Control
- ◆ Ford VCT

This range is not prescriptive or exhaustive and a number of different engine types could be used depending on the particular centre's resources.

If delivered as part of the Automotive Engineering HNC, it may be useful to deliver this Unit in conjunction with the HN Unit, *Automotive Engineering: Engine Management*.

Higher National Unit specification: support notes (cont)

Unit title: Automotive Engineering: Engine Technology

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 current engine technology in Outcome 1. Candidates may be asked to produce an extended response of around 750 words on this topic, or an integrated response of 1,000 words or equivalent for Outcomes 1 and 2. These would allow for development of the *Communication* Core Skill, as would any similar writing on other relevant topics throughout delivery of the Unit.

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 related topics.

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.

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: Engine Technology

This Unit will provide you with the technical knowledge to appreciate the developments and requirements of automotive engines, explaining the operational requirements and applications of automotive engines used in road vehicles.

On completion of the Unit, you should be able to:

- 1 Explain how combustion technology influences cylinder combustion efficiency.
- 2 Explain the construction and operation of one variable valve timing layout.

In Outcome 1, you will learn about combustion technology for both petrol and diesel engines, and the induction manifold and exhaust manifold layouts. You will learn about the effects of these designs on engine performance and emissions.

In Outcome 2, you will learn about various methods of variable valve timing technology and its operation. You will learn about the effects of these designs on engine performance and emissions.

There are opportunities in this Unit to develop the Core Skill of *Communication*.