



National Unit specification: general information

Unit title: Land-based Engineering: An Introduction: Internal Combustion Engines (SCQF level 4)

Unit code: H1MT 10

Superclass: SK

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Version: 02

Summary

This Unit is designed to develop a candidate's basic knowledge and understanding of internal combustion engines to enable them to work with land-based vehicles and equipment. This Unit is suitable for candidates who wish to enter apprentice training to be engineering technicians working on land-based vehicles and equipment. It is a mandatory Unit in the National Certificate in Land-based Engineering: An Introduction at SCQF level 4. It may also be taken as a freestanding Unit.

Outcomes

- 1 Identify internal combustion engine types and their common fuels.
- 2 Identify the main components of internal combustion engines and match them to their functions.
- 3 Carry out routine servicing and adjustments of a single cylinder internal combustion engine.

Recommended entry

Entry is at the discretion of the centre.

Credit points and level

0.5 credit at SCQF level 4 (3 SCQF credit points at SCQF level 4*)

**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.*

National Unit specification: general information (cont)

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Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

Complete Core Skill None

Core Skill component Critical Thinking at SCQF level 4

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

National Unit specification: statement of standards

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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 SQA.

Outcome 1

Identify internal combustion engine types and their common fuels.

Performance Criteria

- (a) Identify the four stroke engine.
- (b) Identify the two stroke engine.
- (c) Identify the common fuels used in internal combustion engines.

Outcome 2

Identify the main components of internal combustion engines and match them to their functions.

Performance Criteria

- (a) Identify components of a four stroke cycle internal combustion engine.
- (b) Identify components of a two stroke cycle internal combustion engine.
- (c) Match components of a four stroke cycle internal combustion engine to their function.
- (d) Match components of a two stroke cycle internal combustion engine to their function.

Outcome 3

Carry out routine servicing and adjustments of a single cylinder internal combustion engine.

Performance Criteria

- (a) Apply routine service procedures, according to manufacturer's guidelines, to an internal combustion engine.
- (b) Adjust an internal combustion engine to perform according to manufacturer's specifications.
- (c) Follow health and safety procedures during all activities.
- (d) Record the servicing activity.

National Unit specification: statement of standards (cont)

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Evidence Requirements for this Unit

All practical activities must be carried out under supervision and in accordance with current health and safety legislation and guidance, codes of practice and manufacturers' recommendations. Personal protective equipment (PPE) must be used wherever necessary. A safety induction must be under taken on workshop practices and the safe use of equipment.

Evidence is required to demonstrate that the candidates have achieved all of the Outcomes and Performance Criteria. Evidence can be produced holistically or Outcome by Outcome.

Written and/or oral and performance evidence must be produced in supervised conditions. All practical tasks must be carried out successfully on at least **one** occasion.

Outcome 1

Written and/or recorded oral evidence gathered under supervised, closed-book conditions. Candidates must:

- ◆ Identify one four stroke cycle engine
- ◆ Identify one two stroke cycle engine
- ◆ Identify two common fuels used to power these engines

Outcome 2

Written and/or recorded oral or performance evidence gathered under supervised, closed-book conditions is required to show that candidates can:

- ◆ Identify eight components of a four stroke cycle internal combustion engine from the following list and match them to their function: crankshaft, connecting rod, piston, piston rings, cam shaft, push rod, rocker arm, inlet valve, exhaust valve, cylinder block, cylinder head or flywheel
- ◆ Identify six components of a two stroke cycle internal combustion engine from the following list and match them to their function: crankshaft, connecting rod, piston, piston rings, inlet port, exhaust port, transfer port, or crankcase

Outcome 3

Performance, written and/or recorded oral evidence gathered under supervised conditions. Candidates must:

- ◆ Perform a routine service on an internal combustion engine according to the manufacturer's specification
- ◆ Adjust a component on an internal combustion engine according to manufacturer's specification
- ◆ Complete a job-card or written record for the tasks carried out and complete records appropriate for maintenance procedures

National Unit specification: support notes

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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 20 hours.

Guidance on the content and context for this Unit

This is a mandatory Unit in the National Certificate in Land-based Engineering: An Introduction at SCQF level 4. It may also be taken as a freestanding Unit.

This Unit is aligned to the following Lantra Sector Skills Council's National Occupational Standards (NOS):

- ◆ LEO 5 Core land-based engineering principles, tools and equipment
- ◆ LEO 8 Core land-based engineering principles servicing and maintenance

The aim of this Unit is to allow candidates to develop knowledge and understanding of the fuels used to power engines together with the construction and operating principles of engines typically used in the land-based sector. Candidates will also develop the technical skills required to service engines, adjust engine components, complete service records and comply with current legislation, safety regulations and current legislation relating to the disposal of waste materials used in the servicing of engines commonly used in the land based sector.

In Outcome 1 candidates should be introduced to the fuels used to power the internal combustion engines fitted to land-based machinery. Candidates should be introduced to the sequence of operation of both four and two stroke cycle engines. Candidates should be able to identify an engine by its running cycle. This could be achieved by candidates viewing cutaway diagrams of engines and identifying the different layout of components for each running cycle.

In Outcome 2 candidates should be introduced to the main components of four and two stroke internal combustion engines. Candidates should develop knowledge of component functions in relation to engine operation. A selection of small engines could be available for candidates to strip down and rebuild to assist in the identification of components process.

In Outcome 3 candidates should be introduced to the procedures required to maintain an internal combustion engine operating at optimum efficiency. This should include servicing and adjusting components to maintain efficient operation. This could include changing engine oil and filter, fuel filters and air filters. The servicing procedures could include the air evacuation process on diesel fuel systems. Candidates could adjust tappets or set engine maximum and minimum speeds.

National Unit specification: support notes (cont)

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Guidance on learning and teaching approaches for this Unit

It is recommended that the Unit is delivered in the same sequence as the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. The Unit can be delivered by varying methods such as lectures, demonstration-lectures and practical exercises. It is recommended that the Unit as a whole takes on a practical emphasis; all aspects of this Unit may be taught in a workshop environment. However, a few classroom sessions to introduce engine cycles and components may assist with candidates understanding. It is recommended that classroom sessions are interactive with animations and media clips to keep learner engagement high.

As Outcome 3 requires candidates to practically service and adjust internal combustion engines in the workshop, it is strongly recommended that candidates are inducted into current legislation, regulations and safe working procedures and practices before starting practical work.

Manufacturers' standards will be observed at all times; operators manuals, workshop manuals and technical data can provide key information for the exercise and are a useful source of learning material for the candidates.

Guidance on approaches to assessment for this Unit

Outcome 1

Assessment could consist of multiple choice questions, diagram identification or structured, short answer questions. This assessment may suit online delivery.

Online delivery would allow for animations of the engine cycles which can be identified by the candidate or a series of still images of the relevant stages of the engine cycles.

State the common fuels used by internal combustion engines and recognise the operating cycles of internal combustion engine. Matching exercises could be used where candidates can match a fuel type to a particular application, eg diesel to 100hp tractor or petrol to a small domestic lawn mower.

Alternatively a selection of engines, suitable for the candidates to achieve the Outcome, could be laid out in a workshop environment, where candidates could identify their cycles and appropriate fuel used to power them.

Outcome 2

Assessment may consist of multiple choice questions, diagram identification or structured, short answer questions. A matching exercise where candidates are given the function of a component and match it to the correct component name may be appropriate. This type of assessment may suit online delivery. Alternatively engine components could be laid out in a workshop environment and candidates could place name cards and functions cards on to the component.

National Unit specification: support notes (cont)

Unit title: Land-based Engineering: An Introduction: Internal Combustion Engines (SCQF level 4)

Outcome 3

Assessment should comprise of practical exercises designed to ensure candidates can gather sufficient evidence to satisfy the Outcome and Performance Criteria. Task instruction sheets, manufacturer's product literature and record forms should be made available to candidates. Observation checklists could be used to record the assessment.

The need for an established safe system of work must be addressed before the candidates begin practical servicing work on engines.

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Opportunities for developing Core Skills

Communication may be developed in Outcome 3 where report/job card writing is possible.

Working Co-operatively with Others and *Reviewing the Co-operative Contribution* may be developed in Outcome 3. Candidates engage in practical work have to interact with their lecturers, support staff and other candidates, for example; while sharing engineering workshop areas, tools and equipment or in developing a plan and completing the routine maintenance of land-based equipment engines. Candidates could be given constructive feedback to encourage the review and evaluation of their approaches to practical work including their contribution to team working.

This Unit has the Critical Thinking component of Problem Solving embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show they have achieved Critical Thinking at SCQF level 4.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

History of changes to Unit

Version	Description of change	Date
02	Core Skills Component Critical Thinking at SCQF level 4 embedded.	06/08/2012

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