

National Unit Specification: general information

UNIT	Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)
NUMBER	DE46 11
COURSE	Scottish Progression Award (SPA) in Vehicle Maintenance and Repair

SUMMARY

This unit will be suitable for candidates who need to develop and apply skills and knowledge associated with the repair, servicing and maintenance of vehicles at Intermediate 2 level. The unit will enable the candidate to acquire essential skills in the identification of the components used within the engine, cooling, lubrication and crankcase ventilation systems.

The unit is derived from Automotive Skills' National Occupational Standards units:

Unit 10 – Remove and replace units and components
Unit 11 – Carry out routine vehicle maintenance
Unit 19 – Inspect vehicles

It also applies to the units relating to vehicle maintenance and repair S/NVQs and Modern Apprenticeships.

It is designed to meet the knowledge requirements of Automotive Skills' Technical Certificate Specification (Phase 1):

LV06 – Engines (1)
LV07 – Lubrication Systems (1)
LV08 – Cooling Systems (1)

and to provide progression towards the S/NVQs and Modern Apprenticeships.

Administrative Information

Superclass:	XS
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National Unit Specification: general information (cont)

OUTCOMES

1. Identify the components of the engine, cooling, lubrication and crankcase ventilation systems.
2. Explain the operation of the engine, cooling, lubrication and crankcase ventilation systems.
3. Explain the routine maintenance requirements for the engine, cooling, lubrication and crankcase ventilation systems.

RECOMMENDED ENTRY

Entry is at the discretion of the centre, but a good standard in communication skills would be desirable. It would also be beneficial for candidates to have a practical aptitude for vehicle maintenance and repair.

CREDIT VALUE

1.5 Credits at Intermediate 2 (9 SCQF points at SCQF level 5*)

**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.*

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, publication code BA0906).

National Unit Specification: statement of standards

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)

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

Identify the components of the engine, cooling, lubrication and crankcase ventilation systems.

Performance criteria

- a) Correctly identify the components of the engine.
- b) Correctly identify the components of the cooling system.
- c) Correctly identify the components of the lubrication system.
- d) Correctly identify the components of the crankcase ventilation system.

OUTCOME 2

Explain the operation of the engine, cooling, lubrication and crankcase ventilation systems.

Performance criteria

- a) Correctly explain the operating cycle of the 2 and 4 stroke engines.
- b) Correctly explain the operation of the engine cooling system.
- c) Correctly explain the operation of the engine lubrication system.
- d) Correctly explain the operation of the crankcase ventilation system.

OUTCOME 3

Explain the routine maintenance requirements for the engine, cooling, lubrication and crankcase ventilation systems.

Performance criteria

- a) Correctly explain the routine maintenance for the engine.
- b) Correctly explain the routine maintenance for the cooling system.
- c) Correctly explain the routine maintenance for the lubrication system.
- d) Correctly explain the routine maintenance for the crankcase ventilation system.

EVIDENCE REQUIREMENTS FOR THE UNIT

Corresponding to all outcomes:

Written evidence of the candidate's ability to (within the engine, cooling, lubrication and crankcase ventilation systems):

- Identify the components
- Explain the operation
- Explain the routine maintenance

The candidate should produce sufficient correct responses to achieve an overall pass of 70% for the unit.

National Unit Specification: support notes

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)

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 60 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This unit is designed to provide the underpinning knowledge for Phase 1 of Automotive Skills' Modern Apprenticeship MA. It also operates in conjunction with the SVQ level II, Vehicle Mechanical, building the underpinning knowledge which will assist in the attainment of the SVQ.

Outcome 1

Engine:

Identify:

- the components and the layout of the assemblies/systems
- valve operation, timing, lag and lead.
- components, which have several parts coming together to make up an assembly i.e. piston, rings, ring belt

The components could be identified from:

Engine – 4 stroke (petrol/diesel):

- cylinder head
- cylinder block
- cylinder liner
- crankshaft
- camshaft
- connecting rod
- piston
- inlet manifold
- exhaust manifold
- sump
- valve train assembly and camshaft assembly

2 Stroke:

- crankcase
- ports/reed valves
- piston
- connecting rod
- crankshaft.

National Unit Specification: support notes (cont)

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)

Cooling system:

Identify:

Water cooled:

- radiator
- water pump
- thermostat
- top hose
- bottom hose
- heater hose
- pressure cap
- expansion tank
- water jacket
- heater matrix
- cooling fan
- thermostatic fan switch

Air cooled:

- cowling
- cooling fins
- air flow flaps
- fan and thermostat

Lubrication system:

Identify:

- oil pump
- primary filter (strainer)
- secondary filter (full flow)
- pressure relief valve
- sump
- dipstick
- oil cooler.

Crankcase ventilation:

Identify:

- oil separator
- PCV valve
- breather pipe/hose

Outcome 2

Engine Operation

The explanation should include:

- engine cycle of operation
- valve positions in relation to the piston
- valve operation
- valve timing diagrams

National Unit Specification: support notes (cont)

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)

Cooling System:

The explanation of both air and water-cooling systems should include:

- the need to take excess heat from the engine
- convection, conduction and radiation
- the need to maintain the engine temperature as near as possible to the recommended normal working temperature
- the effects of over/under cooling
- the interaction of the individual components in the system to maintain the normal working temperature
- need for antifreeze/corrosion inhibitor (all year)
- advantages and disadvantages of air and water-cooling could be established.

Lubrication system:

The explanation should include:

- the flow of oil through the lubrication system
- the interaction of the components in the system to maintain lubrication
- how pressure is maintained within recommended limits
- types and use of oils (SAE/API classification, viscosity, additives, synthetic, semi synthetic and mineral oils)
- advantages and disadvantages of different types of lubrication systems could be established

Crank case ventilation system:

The explanation should include:

- operation of valve and separator

Outcome 3

Engine and lubrication:

Maintenance requirements:

- oil and filter change
- handling oils (scalding, effect on skin/eyes)
- disposal of oils and filters

Manufacturers checks:

- oil level
- leaks (sump, pipes, gaskets and seals)
- identification of oil types and grades
- valve clearance
- timing belt replacement/adjustment

National Unit Specification: support notes (cont)

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase Ventilation Systems (Intermediate 2)

Cooling:

Manufacturers checks:

- leaks (hoses, radiator, heater, cap)
- antifreeze strengths/mixtures
- handling hot systems (scalding)
- pressurised system
- disposal of coolant
- cleaning spillage

Crankcase ventilation:

Manufacturers checks

- condition of pipes
- blockages
- cleaning/changing filter

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Corresponding to all Outcomes:

The candidate could be given the opportunity in a practical situation/location, working on vehicles and actual components/assemblies experiencing practical demonstrations in order to examine the components, develop the knowledge of operation and maintenance of the systems.

A “hands on” approach by the candidate would reinforce the knowledge and develop the practical skills/practice required in the maintenance routines of these systems.

Reference could be made to engine layout/configurations, such as in line, flat, vee, single cylinder and multi cylinder.

Advantages and disadvantages of petrol and diesel engines could be established.

It is recommended that the following terms to be reinforced:

Terms: Top dead centre (TDC), bottom dead centre (BDC) stroke, swept volume, combustion chamber and compression ratio.

Two stroke: Port/valve opening and closing, transfer of mixture, use of deflector (if fitted). Operating cycle position of piston relative to the ports/valves and crankshaft degrees.

4 stroke engine: Degrees of operation per stroke and complete cycle, piston position, valve opening and closing, flow of mixture or air.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Assessment of the knowledge could take the form of a multiple choice test to cover all outcomes.

National Unit Specification: support notes (cont)

UNIT Automotive: Engine, Cooling, Lubrication and Crankcase
Ventilation Systems (Intermediate 2)

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 Arrangements* (SQA, publication code AA0645).