



National Unit Specification: general information

UNIT Land-based Engineering: Forestry Machinery Maintenance
(SCQF level 6)

CODE F91H 12

SUMMARY

This Unit may form part of a National Qualification Group Award or may be offered on a free standing basis.

This largely practical Unit is designed to allow candidates to develop basic knowledge, understanding and skills for the maintenance and repair of arboricultural and forestry machinery. During delivery of the Unit candidates will learn to identify the main parts and describe the operation of a range of arboricultural and forestry machinery. Candidates will also develop the knowledge and skills to dismantle arboricultural and forestry machinery, assess the serviceability of the main component parts and reassemble arboricultural and forestry machinery. They will also learn how to adjust and make any necessary routine or service adjustments to the mechanisms to ensure they function safely and correctly.

OUTCOMES

- 1 Identify component parts and describe the operation of a range of machinery used in arboricultural and forestry operations.
- 2 Overhaul a range of machinery used in arboricultural and forestry operations.
- 3 Carry out routine and service adjustments on a range of machinery used in arboricultural and forestry operations.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained some knowledge and experience of working in a practical engineering environment where forestry or arboriculture machinery has been used.

Administrative Information

Superclass: SK

Publication date: August 2010

Source: Scottish Qualifications Authority

Version: 01

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CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6).

**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

There may be opportunities to develop the following Core Skills:

- ◆ Communication (SCQF level 5)
- ◆ Numeracy (SCQF level 5)
- ◆ ICT (SCQF level 5)
- ◆ Working with Others (SCQF level 5)
- ◆ Problem Solving (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Land-based Engineering: Forestry Machinery Maintenance (SCQF level 6)

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 component parts and describe the operation of a range of machinery used in arboricultural and forestry operations.

Performance Criteria

- (a) Identify correctly the function of machinery used in arboricultural and light forestry operations.
- (b) Describe, with the aid of given diagrams, the operation of machinery used in arboricultural and light forestry operations.
- (c) Identify correctly the methods of powering machinery used in arboricultural and light forestry operations.

OUTCOME 2

Overhaul a range of machinery used in arboricultural and forestry operations.

Performance Criteria

- (a) Dismantle correctly machinery used in arboricultural and light forestry operations in a logical sequence and in accordance with the manufacturer's manual/procedures.
- (b) Assess and report correctly on the condition of the machine's component parts and replace any faulty component parts.
- (c) Reassemble correctly the overhauled assemblies in accordance with the manufacturer's manual/procedures with regard to safe working procedures and practices.
- (d) Correctly test the overhauled assemblies to ensure performance is within manufacturer's specifications.

National Unit Specification: statement of standards (cont)

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OUTCOME 3

Carry out routine and service adjustments on a range of machinery used in arboricultural and forestry operations.

Performance Criteria

- (a) Correctly complete routine/periodic maintenance on machinery used in arboricultural and forestry operations.
- (b) Correctly identify when cutting mechanisms require sharpening to ensure the machine(s) perform within manufacturers' specifications.
- (c) Make any necessary settings or adjustments to the components to ensure the machines will operate within manufacturers' specifications.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral, product and performance evidence supplemented with an assessor observation checklist(s) should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

Outcome 1

Outcome 1 must be assessed by a series of assessments designed to ensure that candidates can generate sufficient evidence to satisfy the Outcome and Performance Criteria. Candidate evidence must be in the form of written and/or recorded oral evidence. Assessments must be conducted under supervised, closed-book conditions in which candidates are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment, with a recommended time limit of one hour. Achievement can be decided by the use of a cut-off score.

With regard to Outcome 1

- ◆ candidates must correctly identify and state the function of two machines (from the following list) used in forestry operations:
 - harvester
 - forwarder
 - skidder
 - stump grinder
- and correctly identify and state the function of two machines (from the following list) used in arboricultural operations:
 - wood chipper
 - shredder
 - saw bench

National Unit Specification: statement of standards (cont)

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- ◆ candidates must correctly describe the operation of two machines (from the following list) used in forestry operations.
 - harvester
 - forwarder
 - skidder
 - stump grinderand must correctly describe the operation two machines (from the following list) used in arboricultural operations.
 - wood chipper
 - shredder
 - saw bench
- ◆ candidates must correctly describe methods of powering machinery used in arboricultural and forestry operations
 - Self-propelled
 - Power Take Off (PTO) powered
 - hydraulically powered
 - electrically powered

Outcome 2

Outcome 2 must be assessed by a series of practical assessments designed to generate evidence of candidates' abilities to successfully overhaul a range of machinery used in arboricultural and forestry operations.

Candidate evidence must be in the form of performance, written and/or recorded oral evidence. Candidates must undertake assessment on their own. Assessment must be conducted under supervised conditions. An observation checklist must be used to record performance evidence of whether candidates have satisfied all the Performance Criteria in the Outcome or not.

With regard to Outcome 2

- ◆ candidates must complete an overhaul of one different sub-assembly on three different types of machine from the following list, one of the machines overhauled should be either a forwarder or harvester
 - harvester (Sub-assemblies; engine/transmission, cab, chassis, bogies and wheels, crane, machine control system)
 - forwarder (Sub-assemblies; engine/transmission, cab, chassis, bunk, bogies and wheels, crane and grab, machine control system)
 - skidder (Sub-assemblies; engine/transmission, cab, chassis, winch, machine control system)
 - wood chipper (Sub-assemblies; power transmission system, feed and cutting and discharge mechanism, carriage, stabiliser units, operator safety mechanisms, machine control system)
 - shredder (Sub-assemblies; power transmission system, cutting mechanism, carriage, stabiliser units, operator safety mechanisms, machine control system)
 - stump grinder (Sub-assemblies; power transmission system, cutting mechanism, carriage, stabiliser units, operator safety mechanisms, machine control system)

- saw bench (Sub-assemblies; power transmission system, cutting mechanism, stabiliser units, operator safety mechanisms, machine control system)

National Unit Specification: statement of standards (cont)

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- ◆ candidates must diagnose and rectify poor cutting performance on two different types of machinery.
 - harvester
 - wood chipper
 - shredder
 - stump grinder
 - saw bench

- ◆ candidates must comply with the relevant dismantling methods and techniques:
 - according to the manufacturers' instructions
 - including the use of special tools — pullers, torque wrenches
 - using manufacturers' special tools
 - using methods of marking components to ensure correct fitting.

- ◆ candidates must store the removed components in accordance with recognised workshop procedures.

- ◆ candidates should re-build sub assemblies using the correct tightening techniques and recommended clearances according to manufacturers recommendations

- ◆ candidates should test overhauled machine(s) to ensure performance is within manufacturers' specifications.

Outcome 3

Outcome 3 must be assessed by a series of practical assessments designed to generate evidence of candidates' abilities to maintain and service a range of machinery used in arboricultural and forestry operations.

Candidate evidence must be in the form of performance, written and/or recorded oral evidence. Candidates must undertake assessment on their own. Assessment must be conducted under supervised conditions. An observation checklist must be used to record performance evidence of whether candidates have satisfied all the Performance Criteria in the Outcome or not.

With regard to Outcome 3

- ◆ candidates must complete routine and service adjustments on a range of machinery used in arboricultural and forestry operations. Any three different machines from the following list, one of the machines serviced should be either a forwarder or harvester:-
 - harvester
 - forwarder
 - skidder
 - wood chippers
 - shredders
 - stump grinder
 - saw bench

- ◆ where fitted candidates must correctly identify if cutting mechanisms require sharpening or adjustment and rectify/adjust to ensure the machine(s) perform within manufacturers specifications.

- ◆ candidates must complete service record sheets in order to confirm compliance with required servicing activities.

National Unit Specification: support notes

UNIT Land-based Engineering: Forestry Machinery Maintenance (SCQF level 6)

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

The aim of this Unit is to allow candidates to develop knowledge and understanding of the construction and operating principles of a range of machinery used in arboricultural and forestry operations. Candidates will also develop the technical skills required to overhaul, carry out scheduled servicing and the routine operator adjustments required to ensure the selected machinery operates within manufacturers' specifications. Candidates will also complete service records to industry standards and comply with current legislation, safety regulations and current legislation relating to the disposal of waste materials used in the servicing of machinery commonly used in arboricultural and forestry operations.

In Outcome 1 candidates should be introduced to the main constructional features and operating principles of a range of machinery used in arboricultural and forestry operations. Candidates should also be able to state the function and describe the operation of the selected machinery. To stimulate candidate interest further, industrial clearfell and/or thinning site visits could be arranged, in order for the candidates to observe the machinery selected operating in a variety of site conditions with the various systems of work being studied.

In Outcome 2 candidates should have the opportunity to underpin the knowledge and understanding they developed in Outcome 1 by gaining practical experience completing refurbishment of machinery used in arboricultural and forestry operations.

Candidates should be encouraged to comply with the relevant dismantling methods and techniques as specified by manufacturers' workshop manuals/instructions and to use industry recommended methods of marking components to ensure correct fitting upon assembly. Candidates should also be encouraged to use manufacturers' data sheets and manufacturers' specialist tools to diagnose and rectify poor cutting performance on machinery. As specialist lifting and handling equipment is usually necessary for some major overhaul tasks, safety considerations often dictate that the required operations on machinery should be completed in a dedicated workshop environment.

In Outcome 3 candidates should have the opportunity to underpin the knowledge, understanding and practical experience they developed in Outcomes 1 and 2 by gaining experience completing the routine/periodic maintenance tasks on a range of machinery at the recommended service/maintenance intervals prescribed by the manufacturer. The candidates should also be encouraged to use manufacturers' service sheets for identifying the servicing tasks required at specified intervals and to complete the required tasks in an industry recommended time. On machinery and where cutting mechanisms or machine control systems are fitted candidates must correctly identify when these mechanisms require sharpening or adjustment and rectify/adjust to ensure the machine(s) perform within manufacturers' specifications.

Candidates should also be encouraged to record the service/maintenance completed as specified on the recommended service record sheet.

National Unit Specification: support notes (cont)

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Maintenance operations undertaken in Outcome 3 could take place either in a workshop environment or on-site.

During the delivery of Outcomes 2 and 3 candidates should be made aware of current legislation, regulations and safe working procedures and practices when working on arboricultural and forestry machinery in a workshop situation or on-site. Candidates must comply with safety regulations, safe working practices and procedures, the wearing of appropriate PPE and with current legislation, safety regulations and current legislation relating to the disposal of waste materials used in the servicing and overhaul of arboricultural and forestry machinery.

HEALTH, SAFETY AND THE ENVIRONMENT

As Outcomes 2 and 3 require candidates to practically service and repair equipment either onsite or in a workshop situation, it is strongly recommended that candidates be inducted into current legislation, regulations and safe working procedures and practices before starting practical work.

A safe system of work should be established in line with the Health Safety and the Environment Unit guidelines while taking cognisance of the candidate's previous experience and abilities prior to the commencement of practical activities. The storage and handling of materials and methods for disposal of waste materials produced during the servicing of land-based equipment should comply with current legislation and good practice. Health safety and environmental issues associated with this Unit **should be taught together with the subject topics and not separately** in the Land-based Engineering: Health, Safety and the Environment Unit.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit.

In delivering Outcome 1 emphasis should be placed on the terminology, constructional features and principles of operation of a range of machinery used in arboricultural and forestry operations. As Outcomes 2 and 3 require candidates to practically overhaul sub-assemblies and service a range of arboricultural and forestry machinery, it is strongly recommended that candidates are inducted into current legislation, regulations and safe working procedures and practices before starting practical servicing work on arboricultural and forestry machinery. It is important that safe systems of working are established in the working environment and candidates are given a thorough grounding in their responsibilities with regard to safe working practices, the hazards of working with tools and equipment and the methods for disposal of waste materials produced during the servicing and overhaul of land-based machinery.

The Unit may be delivered by a combination of lectures, investigations, lecturer demonstration, practical activities and industrial site visits. Industrial site visits, especially for candidates with little or no employment experience in the land-based sector, can be helpful in providing candidates with useful insights into onsite health and safety requirements and environmental considerations for the onsite servicing, overhaul and operation of land-based machinery.

National Unit Specification: support notes

UNIT Land-based Engineering: Forestry Machinery Maintenance (SCQF level 6)

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The Critical Thinking component of *Problem Solving* at SCQF level 5 may be developed in Outcomes 2 and 3 while candidates are involved in analysing the diagnostic test results and deciding upon the most economic use of resources in the approach that will be used to practically completing the servicing and calibration of assemblies on a range of arboricultural and forestry machinery.

The Planning and Organising component of *Problem Solving* at SCQF level 5 may be developed in Outcome 3 while candidates are involved with group practical tasks, as they could be tasked with organising how the required resources will be allocated and have to produce a plan to practically completing the servicing and calibration of assemblies on a range of arboricultural and forestry machinery.

The Reviewing and Evaluating component of *Problem Solving* at SCQF level 5 may be developed in Outcome 3 after candidates have completed the group practical task, as they could review the effectiveness of the plan developed, draw conclusions and suggest a more effective way(s) of completing the task(s).

The *Working with Others* Core Skill at SCQF level 5 may be developed in Outcome 3 while candidates complete the group tasks to service and calibrate assemblies on a range of arboricultural and forestry machinery.

The Working Co-operatively with Others and Reviewing the Co-operative Contribution Core Skill components at SCQF level 5 may be developed in Outcome 3 while candidates engage in practical work as they 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 completion of the servicing and calibration of assemblies on a range of arboricultural and forestry machinery.

The *Communication* Core Skill at SCQF level 5 may be developed in Outcomes 1, 2 and 3 as candidates will be required to produce and respond to detailed and complex written and oral communications.

The practical diagnosis tasks involved with Outcome 3 will give candidates the opportunity to develop both the using Numbers and Using Graphical Information components of *Numeracy* at SCQF level 5 as detailed numerical information and graphs require to be correctly analysed and interpreted, to enable the candidate to calibrate assemblies on a range of arboricultural and forestry machinery. The candidate will also further develop the Using Number component while candidates are involved with group practical tasks, as they could be tasked with organising how resources are allocated, by calculating the most economic method and then tasked with developing a plan to complete the servicing and calibration of assemblies on a range of arboricultural and forestry machinery.

The Using Information Technology Core Skill component at SCQF level 5 may be developed in Outcome 1 as candidates could research and report on the differing machinery types, their constructional features, the servicing requirements and the methods of calibrating assemblies on a range of arboricultural and forestry machinery. It can also be developed in Outcomes 2 and 3 as most

large modern forestry machinery have an electronic machine control system that will require calibration and/or adjustment to ensure the machine(s) perform within manufacturer's specifications.

National Unit Specification: support notes

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GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Health Safety and the Environment

Assessment of health, safety and environmental issues within this Unit could be cross-matched and assessed in the associated Land-based Engineering: Health, Safety and the Environment Unit.

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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. 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)*.

Outcome 1

Assessment may comprise of a series of assessment papers consisting of short answer and structured questions. Partly completed diagrams may be used as part of the assessment. This assessment may be suitable for on-line delivery.

Outcome 2

Assessments comprise 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 manufacturers' specialist tools should be made available to candidates

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

Outcome 3

Assessments comprise practical exercises designed to ensure candidates can gather sufficient evidence to satisfy the Outcome and Performance Criteria. Task instruction sheets, manufacturer's product literature, manufacturers' specialist tools and record forms should be made available to candidates

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

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