National Unit Specification: general information

UNIT Land-based Engineering: Timber Harvesting Heads (SCQF level 6)

CODE F91G 12

SUMMARY

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

This is a practical unit designed to provide candidates with the knowledge, understanding and skills to enable them to dismantle, condition assess, rebuild and test timber harvester heads using safe working practices.

The unit is suitable for candidates training to be service engineering technicians working on forestry equipment.

OUTCOMES

1 Identify the construction and describe the sequence of operation of timber harvester heads.
2 Demonstrate the manufacturers' service procedures for the inspection and dismantling of a timber harvester head.
3 Demonstrate the manufacturers' service procedures required for the condition assessment, repair and rebuild of a timber harvester head.
4 Test and adjust timber harvester head to manufacturer's specification.
5 Check harvester head calibration and the function of the optimisation system.

Administrative Information

Superclass: SK

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally have some awareness of commercial timber harvesting. It would also be useful for candidates to have completed the Unit *Land-based Engineering: Forest Machinery Maintenance*.

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

The Unit provides opportunities for the candidate to develop aspects of the following Core Skills:

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

These opportunities 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 the construction and describe the sequence of operation of timber harvester heads.

Performance Criteria

(a) Identify correctly and outline the function of main components.
(b) Describe correctly the sequence of operation of a selected timber harvesting head.

OUTCOME 2

Demonstrate the manufacturer's service procedures for the inspection and dismantling of a timber harvester head.

Performance Criteria

(a) Clean and inspect a harvester head
(b) Dismantle a timber harvester head following a logical sequence.

OUTCOME 3

Demonstrate the manufacturer's service procedures required for the condition assessment, repair and rebuild of a timber harvester head.

Performance Criteria

(a) Inspect and assess harvester head components for serviceability in accordance with manufacturer's specification.
(b) Carry out repairs effectively following manufacturer's service procedures.
(c) Rebuild a harvester head in a logical sequence following manufacturer's procedures.

OUTCOME 4

Test and adjust timber harvester head to manufacturer's specification.

Performance Criteria

(a) Mount harvester head on a machine or test rig.
(b) Test and adjust the head's basic function following manufacturer's recommended set up procedure.

National Unit Specification: statement of standards

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OUTCOME 5

Check harvester head calibration and the function of the optimisation system.

Performance Criteria

(a) Check calibration by carrying out a manual measurement and comparing the result against the data logged in the machine's computer.
(b) Calibrate the head as required.
(c) Check the optimisation system works within the parameters set by the operator.

National Unit Specification: statement of standards (cont)

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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 is a written and or recorded oral assessment which is assessed in two parts: one to identify and state the function of the main components of a timber harvesting head, the second part requires the candidate to correctly explain the sequence of operations required for a harvester head to complete the processing cycle. Candidate evidence could take the form of a closed book written assessment conducted under closely supervised conditions or as a workshop exercise where the assessor could ask the candidate to identify selected parts from a timber harvester head and outline their function. Video footage of a harvester head in operation could be studied and the candidate asked to explain the sequence of operation from his observations and knowledge of the harvester head's construction.

With regard to outcome 1(a), candidates should identify and state the function of the eight main components of a timber harvesting head.

- Rotator
- Tilt frame
- Moving knives
- Fixed knives
- Stem drive
- Saw
- Hydraulic control valve
- Harvester head control module

For outcome 1(b) the candidate should clearly define the sequence of operations in each of the following stages.

- Felling
- Processing

Outcome 2

Outcome 2 is a practical exercise which is assessed in two parts: one relates to the candidate's ability to clean timber harvester heads using a suitable degreaser and hot / cold water cleaning system observing environmental and recognised health and safety procedures. A visual inspection should be carried out to assess the harvester head for obvious faults; the second part would generate evidence that the candidate demonstrates the ability to dismantle harvester heads safely, identifying component orientation and storing dismantled parts in a systematic manner.

National Unit Specification: statement of standards (cont)

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Assessment must be carried out under supervised conditions; an observation checklist should be used to record whether the candidates have satisfied the criteria in parts one and two. Assessors should carry out oral questioning of the candidate relating to the condition of the harvester head.

Outcome 3

Outcome 3 is a practical exercise which is assessed in three parts: one relates to the candidate's ability to carry out a visual inspection of dismantled components to identify unusual wear characteristics. Components showing such characteristics should be measured and compared against the manufacturer's standards or should be compared to a new unworn component to evaluate serviceability; two requires the candidate to carry out repairs to components effectively, using manufacturer's service procedures and recommended timescales; three requires the candidate to rebuild the harvester head using manufacturer's recommended procedures and observing current health and safety practice.

Assessment must be carried out under supervised conditions. A written report would be used to satisfy the criteria of part one, with an observation checklist used to record whether the candidates have satisfied the criteria in parts two and three.

With regard to Outcome 3

- Candidates must condition assess the following components
  - Chassis
  - Tilt frame and pivots
  - Fixed knife
  - Moving knife
  - Chassis and knife pivot points
  - Stem drive system
  - Metering system
  - Saw assembly
  - Hydraulic rams
  - Hydraulic control valve
  - Wiring harness

Outcome 4

Outcome 4 is a practical exercise which is assessed in two parts: one which assesses the candidate's ability to fit the harvester head to a machine or test rig. All work should be carried out in a safe manner complying with current health and safety recommendations. Two requires the candidate to follow a manufacturer's test sequence for commissioning the harvester head carrying out operational adjustments as required.

Assessment should be carried out under supervised conditions using an observation checklist to record whether the candidate has satisfied the criteria of parts one and two. A risk assessment should be undertaken by the candidate to supplement the evidence for part one.

National Unit Specification: statement of standards (cont)

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Outcome 5

Outcome 5 is a practical exercise which is assessed in three parts: part one requires the candidate to carry out a diameter or length measurement of a selected stem using purpose built calibration callipers or a measuring tape (length measurement) - the reading should be compared to the reading on the machine's computer system, two requires the candidate to reconcile any differences that exist between the measurement taken and the data provided by the machine, three requires the candidate to determine the effective operation of the head optimisation system.

Assessment should be carried out under supervised conditions using an observation checklist to satisfy the criteria of parts one, two and three. Assessors should question the candidate to ascertain their knowledge and understanding of the function and operation of the optimisation fitted.

National Unit Specification: support notes

UNIT Land-based Engineering: Timber Harvester Heads (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

This unit forms part of the National Qualification Group Award in Land-based Engineering at SCQF level 6, but may also be offered on a free standing basis.

The aim of this Unit is to allow candidates to develop basic knowledge, understanding and skills to undertake the dismantling, condition assessment, rebuild, testing and calibration of timber harvester heads found in land-based engineering, and they will also develop skills in measurement, data interpretation, evaluation and report writing.

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 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 Health Safety and the Environment unit

In **Outcome 1** candidates will be introduced to the theoretical aspects of timber harvester heads. They will concentrate on the layout, construction and function of main components as well as understanding the operating sequence of a harvester head as it fells and processes a tree.

In **Outcome 2** the candidate will clean the harvester head thoroughly using a suitable degreaser and hot / cold pressure washer. The candidate should be encouraged to look carefully for signs of excessive wear and physical damage when carrying out the cleaning process. These observations may be recorded in note form for discussion with the assessor as part of the assessment process. Use of appropriate P.P.E. and the adoption of safe working practices should be emphasised and reinforced at this stage. The harvester head once cleaned and inspected should be dismantled following a logical sequence checking component orientation and condition, all parts should be stored carefully for further use or overhaul as appropriate to the component condition, nothing should be discarded at this stage.

National Unit Specification: support notes (cont)

UNIT Land-based Engineering: Timber Harvester Heads (SCQF level 6)

In **Outcome 3** the candidate will carry out a visual inspection of components to identify any unusual wear characteristics before using measuring equipment to assess wear on pivot pins and bushes on the tilt frame and moving knives. The chassis should be checked for integrity to determine its suitability for repair or possible replacement. Wear on knives should be evaluated to identify whether the knives may be re-sharpened or may require replacement. The stem drive system should be carefully inspected to identify signs of physical wear on components but also to ensure that the hydraulic drive motors are serviceable. These may be tested on the head or on a purpose built test rig. The stem metering system should be checked for physical damage and the wiring harness inspected for integrity. The saw assembly should be checked for physical damage and the drive motor should be tested in position or on a purpose built rig. Hydraulic rams may be dismantled for inspection or could be tested for leaks and effective operation. Hydraulic control valves should be inspected and tested where possible and the wiring harness should be checked for integrity with special attention being paid to connections. Any hydraulic hoses showing signs of wear or distress should be replaced. Fatigue cracks in the chassis should be repaired in a manner which prevents the cracks from continuing before "vee" preparation and welding. Reinforcing plates may be incorporated to add strength to the repaired area; repairs should be made to components effectively, using manufacturer's service procedures and recommended timescales.

In **Outcome 4** the candidate should carry out a risk assessment to minimise potential dangers involved in fitting a harvester head to a test rig or harvester. The task should be undertaken using appropriate lifting equipment and should be closely supervised. Once the harvester head is fitted to the machine all hydraulic hoses should be connected to the control valve assembly using notes previously taken or manufacturers' reference material to correctly identify the hose runs and connection points. The electrical harness should be connected to the main loom and the system tested for integrity. The head should be lifted clear of the ground and the machine run to allow hydraulic oil to circulate and for air to be purged from the system. Once the oil is at operating temperature the various functions of the head can be tested and adjusted to the manufacturer's recommended standard.

In **Outcome 5** the candidate is required to take a measurement of a tree stem at a fixed point using a set of calibration callipers, the reading should be logged. The harvester head should then be closed around the same fixed point. The measurement taken by the machine's computer should be compared to the measurement taken by the callipers, any differences should be adjusted on the machine's computer to ensure the diameter measured is accurate. It may be preferable to carry out a stem length calibration where the candidate processes a stem recording the cut length information displayed on the computer, the lengths should then be physically measured using a tape measure and compared to the processed lengths, any difference between processed and measured length identifies a calibration problem which should be reconciled. Candidates should understand the importance of regular machine calibration in relation to the efficient operation of any optimisation system and the impact on meaningful data generated in processing tree stems. Candidates should show an appreciation of and be able to operate the head's optimisation system to access and evaluate data processed by the harvester head in operation.

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Health Safety and the Environment

As Outcomes 2, 3, 4 and 5 require candidates to practically service and repair equipment either on site or in the workshop situation, it is strongly recommended that candidates are inducted into current legislation, regulations and safe working procedures and practices before starting practical work.

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 is designed to be delivered as a practical exercise; it should be carried out in a workshop environment with access to a range of hand tools, welding and lifting equipment Where possible a harvesting head which has been used in commercial operations should be considered as the focus for the unit as it will exhibit typical wear characteristics which are applicable to a range of different manufacturers' heads; workshop manuals and technical data can provide key information for the exercise and are a useful source of learning material for the candidates; manufacturers' standards should be observed at all times.
It is important to be disciplined when delivering this unit. When candidates remove components they should be cleaned and stored in a logical fashion. Where possible components should be checked for manufacturers' marking; if no marking is evident components should be marked carefully avoiding damage to wearing surfaces. Candidates should be encouraged to reflect on work completed and to take notes which will aid them in the re assembly of the harvester head. Health and safety should be reinforced throughout the exercise.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The core skill ***Problem Solving*** at SCQF level 5 may be developed in Outcomes 2, 3 and 4 where critical thinking, planning, organising, reviewing and evaluating are essential elements when carrying out a condition assessment, testing and calibration of a timber harvester head. The candidate requires an effective problem solving approach using theoretical and factual knowledge.

The core skill ***Working with Others*** at SCQF level 5 may be developed in Outcomes 2, 3 and 4 where the candidate will work as part of a small team to clean, dismantle, refurbish, rebuild and commission a used timber harvester head. Candidates may be required to take leadership and responsibility for some of the tasks undertaken. Good practice in using and sharing service engineering workshop areas, tools and equipment could be discussed in terms of the nature and scope of team goals, roles and responsibilities. Candidates could be given constructive feedback to encourage review and evaluation of their approaches to practical work including their contribution to team working.

Elements of the core skill ***Communication*** at SCQF level 5 will be developed in Outcomes 1, 2 and 3 where the candidate uses a wide range of oral and written communication skills in familiar and unfamiliar contexts. Although the candidate works as part of a team where effective verbal interaction with other team members can be observed they will be required to demonstrate practical skills independently and may be questioned by the assessor. Outcome 1 is a written / recorded oral assessment where candidates are required to read and interpret questions. Outcome 3 requires a detailed written report to be completed with conclusions formed.

Elements of the core skill ***Numeracy*** at SCQF level 5 may be developed in Outcome 5 where the candidate uses a range of numerical and graphical data to determine correct calibration of the harvester head. This requires physical measurement to be undertaken and compared to an actual

measurement. Differences have to be calculated and adjustments made to the harvester head's measurement system.

National Unit Specification: support notes (cont)

UNIT Land-based Engineering: Timber Harvester Heads (SCQF level 6)

The core skill ***ICT*** at SCQF level 5 may be developed in Outcomes 3 &5 where the candidate may have to access information on manufacturer's databases or data discs when carrying out the overhaul of the timber harvesting head. A detailed condition report would be completed using a computer and may be E mailed to the assessor.

In Outcome 5 the candidate would use specialist ICT on the timber harvester for calibration and also to operate and set up the optimisation system where the candidate would set up the parameters before operating the machine.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Assessment of health and safety and environment 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).*

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)**.