



## National Unit Specification: general information

**UNIT** Land-based Engineering: Crop Harvesting Machines  
(SCQF level 6)

**CODE** F91F 12

### SUMMARY

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

This Unit is designed to provide candidates with knowledge and understanding of a range of crop harvesting machines. During the delivery of the Unit candidates will develop knowledge of the construction, crop flow and adjustment of components of crop harvesters pertinent to their area. They will also develop the knowledge and skills to perform fault-finding techniques, repair and test components and machines. Candidates will develop practical skills and safe working practices whilst removing, replacing and servicing crop machine systems.

This Unit is suitable for candidates training to be service engineering technicians.

### OUTCOMES

- 1 Describe the purpose, layout, crop flow and working principles of crop harvesting machines.
- 2 Inspect and report on the condition of used crop harvesting machines.
- 3 Dismantle, assess, repair, re-assemble and test sub assemblies of crop harvesting machines.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained at least one of the following, or equivalent:

- ◆ Knowledge of tractor and machine operation
- ◆ NQ Unit *Land-based Engineering: Agricultural Machinery Cultivation and Plant Establishment* at SCQF level 6
- ◆ NQ Unit *Land-based Engineering: Engine Technology* at SCQF level 6
- ◆ NQ Unit *Land-based Engineering: Piston Engine Repair Skills* at SCQF level 6
- ◆ Intermediate 2 Communication
- ◆ Intermediate 2 Numeracy

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### Administrative Information

**Superclass:** SK

**Publication date:** August 2010

**Source:** Scottish Qualifications Authority

**Version:** 01

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## **National Unit Specification: general information (cont)**

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                  (SCQF level 6)

### **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 is no automatic certification of Core Skills in this Unit.

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

|                     |                |
|---------------------|----------------|
| ICT                 | (SCQF level 5) |
| Numeracy            | (SCQF level 4) |
| Communications      | (SCQF level 5) |
| Problem Solving     | (SCQF level 5) |
| Working with Others | (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: Crop Harvesting Machines (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**

Describe the purpose, layout, crop flow and working principles of crop harvesting machines.

##### **Performance Criteria**

- (a) Describe correctly the purpose of crop harvesting machines.
- (b) Identify correctly the layout of components and the crop flow in crop harvesting machines.
- (c) Describe correctly the working principles and function of crop cutting sub-assemblies.
- (d) Describe correctly the working principles and function of crop conveying sub-assemblies.
- (e) Describe correctly the working principles and function of crop processing sub-assemblies.
- (f) Describe correctly the drives to each sub-assembly of the crop harvesting machines.
- (g) Describe correctly the operational adjustments of the crop harvesting machines.

#### **OUTCOME 2**

Inspect and report on the condition of used crop harvesting machines.

##### **Performance Criteria**

- (a) Run and test machines in accordance with the manufacturers' recommendations.
- (b) Identify correctly the condition of sub-assembly components, including drives, on crop harvesting machines.
- (c) Report accurately on the serviceability of each sub-assembly of crop harvesting machines.
- (d) Identify correctly sources of crop loss or damage associated with the machine and its adjustments.
- (e) Identify correctly the out of season maintenance tasks and decommissioning procedures.

#### **OUTCOME 3**

Dismantle, assess, repair, re-assemble and test sub assemblies of crop harvesting machines.

##### **Performance Criteria**

- (a) Carry out the dismantling, inspection and repair of sub-assembly mechanisms of crop harvesting machines in accordance with manufacturer's recommendations.
- (b) Select and use appropriate tools in accordance with industry convention.
- (c) Re-assemble and test the sub-assembly mechanisms of crop harvesting machines in accordance with manufacturer's recommendations.

## National Unit Specification: statement of standards (cont)

**UNIT** Land-based Engineering: Crop Harvesting Machines  
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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

### Range of Machines to be selected for Outcomes of this Unit

|   | <b>Mowers/<br/>Conditioner<br/>/Tedders</b> | <b>Precision<br/>Chop<br/>Forage<br/>Harvester</b>  | <b>Balers</b>   | <b>Combine<br/>Harvester</b>  | <b>Potato<br/>Harvester</b>   | <b>Vegetable<br/>Harvester</b> | <b>Root<br/>Harvester</b> |
|---|---|---|---|---|---|--------------------------------|---------------------------|
| <b>Outcome One</b>  | Yes   | Yes   | Yes   | Yes   | Yes   | Yes                            | Yes                       |
| <b>Outcome Two</b><br>Inspect <u>two</u><br>machines<br>for this<br>Outcome | No  | Option for<br>Inspection in<br>Outcome 2  | Option for<br>Inspection in<br>Outcome 2  | Option for<br>Inspection in<br>Outcome 2  | Option for<br>Inspection in<br>Outcome 2  | No                             | No                        |
| <b>Outcome Three</b><br>Repair <u>one</u><br>machine<br>for this<br>Outcome | No  | Option for<br>Repair in<br>Outcome 3 if<br>the machine<br>was not<br>previously<br>chosen for<br>inspection in<br>Outcome 2 | Option for<br>Repair in<br>Outcome 3 if<br>the machine<br>was not<br>previously<br>chosen for<br>inspection in<br>Outcome 2 | Option for<br>Repair in<br>Outcome 3 if<br>the machine<br>was not<br>previously<br>chosen for<br>inspection in<br>Outcome 2 | Option for<br>Repair in<br>Outcome 3 if<br>the machine<br>was not<br>previously<br>chosen for<br>inspection in<br>Outcome 2 | No                             | No                        |

### Outcome 1

Outcome 1 must be assessed by a single assessment designed to ensure that candidates can generate sufficient evidence to satisfy the Outcomes and Performance Criteria. Candidate evidence must be in the form of written and/or recorded oral evidence. Assessment 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. The assessment should holistically cover the commonly available crop harvesting machines. Total assessment time for Outcome 1 must not exceed 1 hour.

## National Unit Specification: statement of standards (cont)

### UNIT Land-based Engineering: Crop Harvesting Machines (SCQF level 6)

With regard to Outcome 1

- ◆ candidates must describe correctly the purpose of eight crop harvesting machines
- ◆ candidates must describe correctly the crop flow through three crop harvesters
- ◆ candidates must identify the layout of ten sub-assemblies from crop harvesting machines: 3 cutting, 2 conveying and 5 processing
- ◆ candidates must describe correctly the function and working principles of two harvesting machine cutting mechanisms (sub-assemblies)
- ◆ candidates must describe correctly the function and working principles of two crop harvesting machines conveying mechanisms (sub-assemblies)
- ◆ candidates must describe correctly the function and working principles of five harvesting machine crop processing mechanisms (sub-assemblies)
- ◆ candidates must describe correctly the drive lines to two sub-assemblies of two crop harvesting machines
- ◆ candidates must describe correctly the six operational adjustments for each of two crop harvesting machines 2 cutting, 1 conveying and 3 processing

#### Outcome 2

Outcome 2 must be assessed by a series of assessments designed to generate evidence of candidates' abilities to identify faults in two different types of crop harvesting machines.

Candidates must undertake assessment on their own and the assessment conducted under supervised conditions.

- ◆ Candidate evidence must be in the form of performance and written and/or recorded oral evidence. An observation checklist must be used to record the evidence of candidates having satisfied all the Performance Criteria in the Outcome. Assessment must be conducted under supervised conditions.

With regard to Outcome 2

- ◆ candidates must run and test two crop harvesting machines in accordance with the manufacturers' recommendations from the following list: baler, precision chop forage harvester, combine harvester, potato harvester
- ◆ candidates must identify the condition of components, including drives for cutting, conveying, processing, on the chosen crop harvesting machines
- ◆ candidates must report accurately the serviceability of each sub-assembly (cutting, conveying and processing) of each chosen crop harvesting machine
- ◆ candidates must identify correctly potential sources of crop loss, damage or contamination on each chosen crop harvesting machine
- ◆ candidates must identify the settings and state appropriate corrective adjustment to minimise crop loss, damage or contamination associated with the chosen crop harvesting machines in line with the manufacturers' recommendations
- ◆ candidates must identify out of season maintenance tasks and decommissioning procedures on the chosen crop harvesting machines

## National Unit Specification: statement of standards (cont)

**UNIT** Land-based Engineering: Crop Harvesting Machines  
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### Outcome 3

Outcome 3 — candidates must, in accordance with the manufacturer's recommendations, dismantle, assess, repair, re-assemble and test the sub assemblies from **one crop harvesting machine** from the Following list: baler, precision chop forage harvester, combine harvester, potato harvester **not previously chosen for inspection in Outcome two.**

Assessment will be by a series of assessments designed to generate evidence of candidates' abilities to dismantle, inspect, repair and/or adjust one crop harvesting machine from the above list. Candidates must undertake assessment conducted under supervised conditions in small groups (2/3 persons) but each should be assessed individually.

Candidate evidence must be in the form of performance and written and/or recorded oral evidence. An observation checklist must be used to record the evidence of candidates having satisfied all the Performance Criteria in the Outcome.

With regard to Outcome 3

- ◆ candidates must dismantle, inspect, repair and/or adjust, re-assemble and test **two** sub-assembly mechanisms from **one** crop harvesting machine from the above list not chosen in Outcome two in accordance with manufacturer's recommendations
- ◆ candidates to participate in the running and testing of the complete crop harvesting machine
- ◆ candidates must use appropriate tools and conform to convention in their use
- ◆ candidates must produce an accurate job card describing the serviceability of **the two sub-assembly** mechanisms of the crop harvesting machine
- ◆ observation checklist to be produced by the centre as evidence of the candidate's ability to follow instructions, correct use of tools, observe relevant/set safety requirements for the given tasks and carry out service and test procedures correctly and within realistic time scales.

## National Unit Specification: support notes

### UNIT Land-based Engineering: Crop Harvesting Machines (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. It can operate in conjunction with the SVQ Level 3 in Land-based Engineering Operations, providing candidates with the knowledge and understanding required to service and repair crop harvesters appropriate to their area.

The aim of this Unit is to develop their knowledge, understanding and skills of crop harvesting machines from the following, grass mower and conditioner, forage harvester, baler, combine harvester, potato harvester, and vegetable harvesters used in agriculture and field scale horticulture.

A sub-assembly is considered to be a substantial part of the machine eg a combine harvester threshing assembly or forage harvester pick-up assembly or potato harvester stone/clod potato separator.

Sub-assemblies to be covered include:

**Cutting:** reciprocating knife, rotating blade, flails

**Conveying and elevating:** pick-up tables, augers, blowers, conveyor belts, web chains, paddles, rollers.

**Processing:** threshing, separation (mechanical and/or electronic and/or pneumatic), compression, tying, wrapping, meter chopping, disposal/dispersal of waste products.

On successful completion of the Unit candidates will be able to identify and describe the functions of sub-assemblies and components of machines applicable to harvesting and processing the following crops:

- ◆ grass
- ◆ cereals
- ◆ potatoes
- ◆ roots/vegetables

Areas of potential failure and wear, the need for settings, adjustment and torque settings, effects of incorrect operational settings and adjustments eg crop loss and damage. The removal, inspection and replacement procedures for harvesting and processing machine sub-assemblies and components.

The candidate could be given the opportunity to examine in a practical location crop harvesters, including, identification of the main components, layout, principles of operation of the systems and components. Factors that affect crop loss and quality could be further discussed in a classroom situation.

## National Unit Specification: support notes (cont)

### UNIT Land-based Engineering: Crop Harvesting Machines (SCQF level 6)

Demonstration of the methods used to determine wear in the main sub-assemblies and components, crop related adjustments. Sub assemblies could be dismantled, inspected and compared to manufacturers' specifications.

Correct use of tools and observation of safe working practices should be encouraged at all times. The potential hazards associated with high pressure fluids, dust, heat and disposal of fluids should be highlighted to the candidate.

#### RANGE of MACHINES

Grass Cutting and Conditioning Machines:

*Mowers, tedders, conditioners,*

Grass Precision Chop Harvesting Machines:

*Trailed pto driven self propelled forage harvesters,*

Balers:

*small square, round and big square*

Cereal Harvesting Machines:

*Combine harvesters conventional and axial flow*

Potato Harvesting Machines:

*Harvesters manned and unmanned with mechanical or electronic separation*

Vegetable Harvesting Machines:

*Carrot, brassica*

Root Harvesting Machines:

*Turnip, beet*

## GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

### HEALTH SAFETY AND ENVIRONMENTAL

As Outcomes 2 and 3 require candidates to practically service and repair equipment either onsite or in 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.



## National Unit Specification: support notes (cont)

### UNIT Land-based Engineering: Crop Harvesting Machines (SCQF level 6)

In Outcome 1 candidates should learn the purpose of all the machines in the complete range of crop harvesting machines. They should then specialise in three major machines/crop harvesters relevant to their area and learn the layout of components, drives to sub-assemblies, working principles and operational adjustments. This should include a baler and either grass or cereal harvesting equipment, root/vegetable or a second grass/cereal harvesting machine. The candidate should demonstrate an understanding of the operational adjustment on the machines chosen and if possible include real work conditions.

In Outcome 2 candidates should inspect and report on the condition of **two complete** machines from either grass or cereal or root harvesting equipment ranges. The candidate should complete the tasks designated by the lecturer which demonstrates the candidate's ability to successfully inspect used equipment with faults and allow them to provide a written or oral report on the condition of the crop harvesters.

In Outcome 3 candidates should participate in the completion of tasks designated by the lecturer where the candidate's ability to successfully dismantle, assess need for repair of sub-assemblies, rectify and then reassemble the components of a used machine is assessed. The machine should then be tested and set-up in accordance with the manufacturer's recommendations ensuring that the whole machine functions and is fit for purpose. Manufacturers' time scales should be referenced and although it is not expected the candidate will achieve skilled service engineer times it is anticipated they should complete tasks in reasonable time scales.

### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill component *Using Information Technology* at SCQF level 5 may be developed in Outcomes 2 and 3 where job card/report writing is specified. As Crop Harvesting equipment especially combine harvesters, have electronic machine control systems which require calibration and/or adjustment to ensure they perform within manufacturer's specifications, further development opportunities exist. Candidates may research and report on the harvester types, their constructional features, working principles and crop flow in Outcome 1, repair, servicing requirements and the methods of laying up machinery at the end of season in Outcomes 2 and 3.

Elements of *Numeracy* SCQF level 4 may be developed in Outcomes 2 and 3 where various aspects of equipment performance, machine speeds and crop loss percentages are determined during the final testing. Using Graphical Information at SCQF level 5 may be developed in Outcome 2 as candidates are given data, machine speeds, crop loss and use this to practically set up crop harvesting equipment units they are servicing. Centres have opportunities to develop Numeracy skills with the aid of contextualised reference and support materials provided to the candidate.

Elements of *Communication* at SCQF level 5 may be developed in Outcomes 1, 2 and 3. Candidates will be required to produce and respond to detailed and complex written and oral communications in Outcome 1 as they investigate the working principles and functions of the range of crop harvesting machines in use. In reporting on serviceability in Outcome 2 and producing a job card report in Outcome 3 they are communicating detailed written conclusions about the dismantling, assessing, repair and testing of crop harvesting machinery.

## National Unit Specification: support notes (cont)

### UNIT Land-based Engineering: Crop Harvesting Machines (SCQF level 6)

The Critical Thinking component of *Problem Solving* at SCQF level 5 may be developed in Outcome 3 while candidates are practically planning how to complete the servicing and routine maintenance of crop harvesting 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. They could be tasked with organising how the required resources will be allocated and have to produce a plan for the completion of the dismantling, assessing, repair and testing of crop harvesting machinery using the most cost effective method.

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 of completing the allocated tasks.

Elements of *Working with Others* Core Skill at SCQF level 5 may be developed in Outcome 3 while candidates complete group tasks, dismantling, assessing, repair and testing of crop harvesting machinery

Working Co-operatively with Others and Reviewing the Co-operative Contribution at SCQF level 5 may be developed in Outcome 3. Candidates engaging 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 completion of the intended dismantling, assessing, repair and testing of crop harvesting machinery.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

A single, holistic assessment paper of short answer and or restricted response questions may assess Unit knowledge in Outcome 1. Alternatively assessment of individual parts of the Outcome could be carried out at appropriate points during Unit delivery. Candidate evidence must be in the form of performance and written and/or recorded oral evidence.

Formative assessment exercises involving candidates in workshop inspections and repair skills acquisition will play a particularly important role in building candidate knowledge, understanding, skills and confidence of Unit content. Candidates would be required to complete an appropriate written job card/inspection report document associated with Outcomes 2 and 3. An observation checklist must be used to record the evidence of candidates having satisfied all the Performance Criteria in Outcomes 2 and 3

**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.

## **National Unit Specification: support notes (cont)**

**UNIT** Land-based Engineering: Crop Harvesting Machines  
(SCQF level 6)

### **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)*.

### **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](http://www.sqa.org.uk/assessmentarrangements)