

Next Generation Higher National Unit Specification

Principles of Mechanisation

Unit code: J8G5 47
SCQF level: 7 (16 SCQF credit points)
Valid from: session 2024 to 2025

**Prototype unit specification for use in pilot delivery
only (version 2.0) November 2024**

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year. It is for lecturers and assessors and contains all the mandatory information you need to deliver and assess the unit.

The information in this unit specification may be reproduced in support of SQA qualifications only on a non-commercial basis. If it is reproduced, SQA must be clearly acknowledged as the source. If it is to be reproduced for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

This edition: November 2024 (version 2.0)

© Scottish Qualifications Authority 2024

Unit purpose

This unit is designed for learners studying an HNC in Agriculture. It focuses on the role of machinery in modern agricultural practices.

The unit covers a broad range of topics, from the fundamentals of agricultural machinery, including engines and power systems, to the application of electricity in farming.

The unit content emphasises the importance of understanding the operation, selection and maintenance of various agricultural machines to improve the efficiency and sustainability of mechanisation in agriculture.

Entry to the unit is at your centre's discretion. Learners do not need any prior knowledge or experience to do this unit, though previous study of mathematics at SCQF level 5 would be helpful.

Unit outcomes

Learners who complete this unit can:

- 1 explain how an engine works
- 2 analyse different types of machinery used in agricultural settings
- 3 explain how electricity is used agriculture

Evidence requirements

To achieve these outcomes, learners must provide the following evidence:

Outcome 1

- ◆ Explain the principles of how prime movers operate, and how internal combustion engines using fuels including hydrogen work.
- ◆ Explain the workings of electric motors as prime-mover motive power.
- ◆ Explain how engines generate power and torque.
- ◆ Explain how transmissions translate power and torque to useful work.
- ◆ Explain the fundamentals of hydraulic systems in a modern tractor.

Outcome 2

- ◆ Describe a range of cropping and livestock machinery including their function, operation and maintenance requirements.
- ◆ Analyse a specific agricultural task to select suitable machinery.

Outcome 3

- ◆ Describe the use of electricity in agricultural settings.
- ◆ Explain electrical safety on farms.
- ◆ Explain the principles of electrical circuits, and how to apply electrically powered equipment.

Knowledge and skills

Knowledge	Skills
<p>Outcome 1 Learners should understand:</p> <ul style="list-style-type: none"> ◆ engines, power, and torque and the impact they have on machine selection ◆ the fundamental principles of prime-mover operation, including internal combustion engines using various fuels including hydrogen ◆ the role of fuel additives in reducing gaseous emissions ◆ electric motors as prime-mover motive power ◆ how engines and motors generate power and torque ◆ how transmissions translate power and torque to useful work ◆ the fundamentals of hydraulic systems in a modern tractor 	<p>Outcome 1 Learners can:</p> <ul style="list-style-type: none"> ◆ explain the basic operation of prime movers, including how internal combustion engines use different fuels, such as hydrogen, to produce energy ◆ describe the role of fuel additives and selective catalytic reduction in reducing harmful gases being released to atmosphere ◆ describe how electric motors function as a primary source of motive power ◆ discuss the process through which engines and motors create power and torque and how transmissions translate that to useful work ◆ describe a simple hydraulic circuit
<p>Outcome 2 Learners should understand:</p> <ul style="list-style-type: none"> ◆ a range of machinery, such as primary and secondary cultivation tools; seed drills; fertiliser spreaders; harvesters; and machinery used in livestock management, including feed-processing and bedding equipment, milking machines and manure management systems ◆ the function, operational techniques and maintenance requirements of a range of machinery 	<p>Outcome 2 Learners can:</p> <ul style="list-style-type: none"> ◆ identify and describe various types of agricultural machinery, including primary and secondary cultivation tools, seed drills, fertiliser spreaders and harvesters, feed-processing equipment, milking machines and manure management systems ◆ explain the purpose, operational methods, and upkeep needs of different agricultural machines ◆ use this understanding to choose equipment for particular farming activities ◆ how to use their knowledge to select suitable machinery for specific agricultural tasks

Knowledge	Skills
<p>Outcome 3 Learners should understand:</p> <ul style="list-style-type: none"> ◆ how electricity is used in agricultural settings ◆ electrical safety on farms, the basics of electrical circuits, and how to apply electrically powered equipment 	<p>Outcome 3 Learners can:</p> <ul style="list-style-type: none"> ◆ describe the role of electricity in agricultural operations and its benefits ◆ explain electrical safety practices on farms, understand the fundamentals of electrical circuits, and discuss the use of electrically powered equipment in agriculture, such as automated feeding systems and climate control in farm buildings, and their impact on agriculture

Meta-skills

You must give learners opportunities to develop their meta-skills throughout this unit. We've suggested how to incorporate the most relevant ones into the unit content, but you may find other opportunities.

Self-management

This includes focusing, integrity, adapting and initiative. The most relevant are:

- ◆ Focusing: collecting and assimilating accurate and meaningful data on which to base decisions, by filtering out non-essential material
- ◆ Adapting: developing a capacity to apply information from diverse technical fields (mechanical engineering and electrical systems) to make informed decisions regarding agricultural mechanisation

Social intelligence

This includes communicating, feeling, collaborating and leading. The most relevant are:

- ◆ Communicating: building communication skills, particularly an ability to listen, receive and give information for improved decision making
- ◆ Leading: committing to selecting agricultural machinery that leverages renewable energy and promotes long-term sustainability of resources

Innovation

This includes curiosity, creativity, sense-making and critical thinking. The most relevant are:

- ◆ Creativity: designing and recommending mechanisation strategies that enhance productivity while reducing environmental impact
- ◆ Sense-making: developing an ability to dissect and understand engineering concepts, and apply them to real-world agricultural machinery problems
- ◆ Critical thinking: assessing various machinery and technology options for their efficiency, suitability and sustainability, while considering both current and future agricultural needs

Literacies

This unit provides opportunities to develop the following literacies.

Numeracy

Learners have opportunities to develop numeracy knowledge, understanding and skills throughout the unit. In particular, they learn to apply mathematical methods to mechanisation in agriculture; for example to power, torque and speed analyses.

Communication

Learners have the opportunity to develop their written, graphical and verbal communication skills. Communication skills are developed throughout from classroom and workshop practice tasks and discussions.

Digital

Learners can develop and enhance their digital literacies in their use of word-processing, spreadsheet and presentation software in all their learning outcomes.

Learning for Sustainability

Throughout this unit, you should encourage learners to develop their skills, knowledge and understanding of sustainability.

This includes:

- ◆ a general understanding of social, economic and environmental sustainability
- ◆ a general understanding of the United Nations Sustainable Development Goals (SDGs)
- ◆ a deeper understanding of subject-specific sustainability
- ◆ the confidence to apply the skills, knowledge, understanding and values they develop in the next stage of their life

The unit gives learners the underlying principles they need to apply scientific theory and practice to the efficient operation of machinery, thereby reducing machinery's environmental impact. The course enables the learner to understand the use of machinery and energy on the farm, and to improve the efficiency of mechanisation as an integral part of improving industry sustainability.

The evolution of agriculture into a mechanisation-driven industry should make the sector more efficient, both financially and in terms of production volumes. It should also significantly help to meet local and global sustainability goals.

Delivery of unit

This unit involves covering both theory and practice in classroom-, farm- and workshop-based tasks. As you deliver the unit, you should arrange visits to a range of livestock farms, as well as teaching the theoretical knowledge.

The amount of time you allocate to this unit is at your discretion. However, the notional design length is 80 hours. The amount of time you allocate to each outcome is flexible, but each outcome is considered to be of equal demand. The assessment weightings should be:

- ◆ outcome 1 — 30%,
- ◆ outcome 2 — 40%
- ◆ outcome 3 — 30%

This is a mandatory unit in HNC Agriculture. You can deliver it as a stand-alone unit, or partially integrate it with elements of the Principles of Livestock Production, Principles of Crop Production or Professional Practice and Skills units.

There are opportunities to combine or integrate assessments with those for the Principles of Crop Production or Principles of Livestock Management units.

Additional guidance

The guidance in this section is not mandatory.

Approaches to delivery

The unit offers a degree of flexibility in how you deliver the different outcomes.

We recommend that, whenever possible, you include industry collaboration and guest speakers in your course delivery.

You could:

- ◆ invite guest speakers from the agricultural industry, including farmers and agricultural machinery dealers, to share their experiences and perspectives on the use of data in agriculture
- ◆ invite collaborations with industry partners to provide learners with real-world projects, internships or work placements where they can apply their skills in agricultural mechanisation

Cropping and livestock machinery would include but is not limited to:

- ◆ harvesters
- ◆ seed drills
- ◆ tillage tools
- ◆ feed and bedding processing equipment
- ◆ milking machines
- ◆ manure management systems

Approaches to assessment

You can assess this unit in a variety of different ways, and many beyond what we suggest here are also valid.

We recommend that you:

- ◆ implement formative assessment strategies throughout the unit to gauge learners' understanding and progress
- ◆ provide timely and constructive feedback on learners' work, focusing on both the process and the outcome
- ◆ use a variety of assessment methods, including written assignments, oral presentations, group projects and practical demonstrations, to assess learners' proficiency and their ability to apply these skills in agricultural technology contexts

Outcome 1

You could use quizzes that focus on the fundamental principles of powering agricultural machinery.

Outcome 2

You could suggest learners complete a project in which they apply knowledge to a real or simulated agricultural setting, selecting appropriate range machinery for an appropriate mechanised operation on a farm, to include both a crop and livestock example.

Examples could include:

- ◆ silage
- ◆ crop establishment
- ◆ crop harvesting
- ◆ slurry application feeding operations

You could combine or integrate these assessments with those for Principles of Crop Production and/or the Principles of Livestock Management project assessment.

Outcome 3

You could assess this outcome with a quiz or short-answer test, and a practical assessment on electrical circuits.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You must consider the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and those with additional support needs is available on the [assessment arrangements web page](#).

Information for learners

Principle of Mechanisation (SCQF level 7)

This information explains:

- ◆ what the unit is about
- ◆ what you should know or be able to do before you start
- ◆ what you need to do during the unit
- ◆ opportunities for further learning and employment

Unit information

This unit gives you the knowledge and skills to objectively evaluate mechanical plant and equipment for optimum business efficiency. During the unit, you consider topics related to the principles of mechanisation in agriculture.

You do not need any prior knowledge or experience to do this unit, but you would find it helpful to have studied mathematics at SCQF level 5.

You are assessed using a variety of formative and summative assessment methods, and these are likely to include completing an appropriate number of workshop and field exercises.

You are encouraged to keep a log of your reflections as you develop meta-skills, digital literacies, industry knowledge and wider employability skills throughout the teaching and assessment processes.

When you have completed this unit, you can:

- ◆ explain how an engine works
- ◆ analyse different types of machinery used in agricultural settings
- ◆ explain how electricity is used agriculture

Meta-skills

This unit helps you to enhance you meta-skills in the following ways.

- ◆ **Self-management:** focusing on collecting and assimilating accurate and meaningful data on which to base decisions, by filtering out non-essential material; developing a capacity to apply information from diverse technical fields (mechanical engineering and electrical systems) to make informed decisions regarding agricultural mechanisation
- ◆ **Social intelligence:** building communication skills, particularly an ability to listen, receive and give information for improved decision making; committing to selecting agricultural machinery that leverages renewable energy and promotes long-term sustainability of resources
- ◆ **Innovation:** developing experience and skills in curiosity, creativity, critical thinking in the context of agricultural practice

NextGen: HN published prototype unit specification for use in pilot delivery only (version 2.0)
November 2024

Sustainability

The unit gives you the underlying principles required to apply scientific theory and practice to sustainable food production, land use, water resource management and energy supply.

This unit is part of the HNC Agriculture. It gives you the knowledge and skills to select and work with agricultural machinery on a farm. On completion of the HNC you may be able go on to study the HND Agriculture, or go directly into employment.

Administrative information

Published: November 2024 (version 2.0)

Superclass: SK

History of changes

Version	Description of change	Date
2.0	Refreshed and refined outcome wording, and associated information.	November 2024

Please check [SQA's website](#) to ensure you are using the most up-to-date version of this document.