Unit 7: Undertaking Land-based Machinery Operations

Unit code: H/600/9805

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

In this unit learners will study the purpose and operation of land-based machines including machine layout, systems and controls. They will explore daily checks and adjustments as well as appropriate personal protective equipment and the legal and recommended requirements for land-based machinery. They will learn how to safely operate and maintain machinery and consider the different conditions in which machinery might need to operate.

Unit introduction

The ability to understand and operate the range of machines used in the land-based industry is essential. A wide variety of general purpose and specialised machines and attachments are used within the industry and, through this unit, learners will learn about the machines that are commonly used and how to operate and service them.

To operate machines for a variety of tasks under different conditions efficiently and safely requires a high degree of skill and understanding. Learners must be rigorous in assessing risks and adopting safe working practice at all times.

On completion of this unit learners will be able to prepare, operate, service and carry out basic repairs. They will also be aware of the legislation concerning the use of land-based machinery.

Learning outcomes

On completion of this unit a learner should:

1 Understand the purpose and operation of land-based machines

2 Be able to prepare land-based machines ready for work

3 Be able to safely operate land-based machinery

4 Be able to carry out operator maintenance and simple repairs.

Unit content

1 Understand the purpose and operation of land-based machines

Purpose of machines: traction; cultivation; excavation; estate maintenance; application of materials; transport, cutting, mowing; attachments and options for different conditions or tasks; advantages; disadvantages

Principles of operation: machine layout; machine systems eg hydraulic, hydrostatic, electrical; power production and transmission; operating sequence; controls

Health and safety: current relevant legislation and codes of practice eg Health and Safety at Work Act 1974, Provision and Use of Work Equipment Regulations 1998 (PUWER), Control of Substances Hazardous to Health Regulations 1999 (COSHH), Federation of European Producers of Abrasives (FEPA) documents and standards, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR); manufacturers' instructions; risk assessment

2 Be able to prepare land-based machines ready for work

Preparation: pre-start and daily checks; adjustment; attachments; lubrication; use of personal protective equipment (PPE); guarding; heights of cut; blade depth

Facilities: workshop; benches; tools; parts; consumables eg lubricants, cleaning agents

3 Be able to safely operate land-based machinery

Operation: starting; safe operation of machines appropriate to sector; efficient and safe working procedures and sequences; health and safety; risk assessment; response to emergency situations

Range of conditions: in the field eg weather, soil type, ground conditions, slope; site size and access; restrictions due to noise; public access

4 Be able to carry out operator maintenance and simple repairs

Maintenance: use of operator's manual; renew oils; clean or renew filters; adjustments eg tensions, pressures; record keeping; health and safety

Relevant repairs: eg replacement of belts, tines, blades, battery replacement; spark plug replacement; guard replacement

Fault identification: worn transmission and steering components; tyres; cutting blades; tines; knives; faulty guarding; spark plug; blocked filters; use of manufacturers' part numbers and machine identification; health and safety

Servicing and repair options: dealership services 'in-house' servicing and repairs by own mechanic; warranties; cost effectiveness

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 explain the purpose and safe operation of selected land-based machines	**M1** compare the principles of operation of selected land-based machines	**D1** discuss the effects of current relevant legislation and codes of practice on the operation of given land-based machinery
P2 discuss the differences between selected land-based machines [CT]		
P3 prepare selected land-based machinery ready for work safely [IE]	**M2** compare the different ways of mounting a range of specified attachments to land-based machinery	
P4 review the pre-start checks and safety requirements for selected land-based machinery [EP]		
P5 operate selected land-based machinery to meet given objectives safely [SM]	**M3** justify the selection and operation of land-based machinery for a given task	**D2** evaluate the efficient use of selected land-based machines for given site/field conditions
P6 explain the safe operation of selected land-based machinery	**M4** justify the selection and operation of land-based machinery with suitable attachments for a given task	
P7 carry out operator maintenance and appropriate repairs for selected land-based machinery	**M5** explain potential faults and/or defective parts on a given land-based machine using manufacturer's data to specify replacement items.	**D3** evaluate the options available for the repair and servicing of given land-based machinery.
P8 assess potential faults and/or defective parts on a given land-based machine.		

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable collections and will link to work experience placements.

In studying this unit learners will combine the practical operation of land-based machinery with workshop tasks concerned with their maintenance. Learners will need to know how to prepare machinery for use and be able to carry out routine servicing and fault finding.

To complete this unit, learners will need access to a variety of machines, attachments and workshop facilities. In addition, they will need a comprehensive understanding of the health and safety aspects of operating machines and be confident in attaching, adjusting and operating equipment according to the legal framework and guidelines for their use.

The use of visiting practitioners, videos and classroom sessions should support practical work to ensure learners are competent. Learners will need to demonstrate their competence in a variety of operating conditions.

Care should be taken where practical work involves cutting or other moving parts and attention should be paid to substances hazardous to human health, for example fuels and lubricants, and their safe and legal use and disposal. Adequate personal protection equipment must be provided and used following the production of suitable risk assessments. Learners must risk assess their own activities, particularly where difficult conditions prevail or they are using unfamiliar equipment.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction and overview of the unit.
Assignment 1: Land-based Machinery: the framework (P1, P2, M1, D1) Introduction to the assignment brief.
Practical familiarisation with a range of land-based machines.
Classroom session on legal requirements and codes of practice.
Production of catalogue.
Evaluation of catalogue and other evidence.
Assignment 2: Land-based Machine Operation (P3, P4, P5, P6, M2, M3, M4, D2) Introduction to the assignment brief.
Practical land-based machinery operation.

Topic and suggested assignments/activities and/assessment
Production of logbooks and other evidence.
Evaluation of practical skills.
Assignment 3: Land-based Machine Maintenance and Repair (P7, P8, M5, D3) Introduction to the assignment.
Practical demonstrations including fault finding.
Practical maintenance and repair skills.
Classroom sessions on workshop procedures and repair techniques.
Risk assessment theory and practical exercise.
Unit review.

Assessment

For P1, learners will need to become familiar with the range of land-based machines and their purpose. Ideally this should include the machines they will be using. Where the range is restricted, catalogues, visits to dealers and county shows and relevant work placements could be used. Evidence could be generated through question and answer sessions led by the tutor or by learners compiling their own gallery of photographs, pictures and descriptions.

P2 covers the differences between selected land-based machines and the advantages and disadvantages for specific tasks should be considered. Comparing price, power and operation are also valid lines of enquiry. Evidence for this could be included within the evidence for P1.

For P3 and P4, learners will need to demonstrate that they can prepare specified land-based machines for work. They should be able to carry out pre-start and daily checks on the equipment together with any remedial action that might be needed, for example adjusting fluid levels. Learners should be able to attach the relevant machinery needed and carry out any adjustments. Evidence for P3 and P4 could be observation records together with a logbook. Video records would also be appropriate. Assessment of P3 and P4 must reflect learners' consideration of safe working practices, risk assessment and use of personal protection equipment.

For P5, learners must show they are able to start and operate appropriate land-based machinery to meet specific objectives. They should show they can make field adjustments where needed and operate the machinery under a variety of conditions including emergency situations. Evidence for P5 could be as for P3 and P4, namely observation records and logbooks. Assessment of P5 must reflect learners' consideration of safe working practices, risk assessment and use of personal protection equipment.

For P6, learners must show they understand the factors that can influence the safe operation of land-based machinery. Learners should consider, for example, soil type, ground conditions, operator experience and other factors listed in the unit content.

For P6, learners can build on the skills developed for P5 by considering situations they have not encountered in practical tasks. Evidence for P6 could be tutor-led discussion notes or through interviewing more experienced practitioners.

For P7, learners need to be able to service appropriate land-based machines according to manufacturers' instructions. This will include basic checks of electrical systems, fluid levels, pressures and tensions. Repairs should be those that would be expected from a competent operator. Evidence for P7 could be the completion of maintenance record sheets together with logbooks and observation records. Assessment of P7 must reflect learners' consideration of safe working practices, risk assessment and use of personal protection equipment.

For P8, learners need to be able to determine basic faults that may occur for a specified land-based machine. They should be able to analyse a situation and fault find. Assessment could use faults deliberately induced by the tutor with evidence as flow charts or observation records and log books.

For M1, learners should compare the operating systems of various land-based machines. They should understand different ways of producing and transmitting power. Evidence for M1 could build on that produced for P1 and P2.

For M2, learners should be able to demonstrate the versatility of land-based machines by showing they understand their use and are able to compare attachments for specified purposes. This could range from a simple ball hitch to more complex hydraulic and three point linkages. Evidence for this could be through logbooks and observation records. Assessment of M2 must reflect learners' consideration of safe working practices, risk assessment and use of personal protection equipment.

M3 and M4 require learners to analyse tasks and then select the appropriate land-based equipment to complete them safely and efficiently. M4 specifically requires learners to attach equipment for successful task completion and tasks should be chosen to reflect this. M3 and M4 build on P5 as learners need to select appropriate machinery and assessment should reflect this. Notes from tutor-led question and answer sessions would provide suitable evidence.

M5 requires learners to have a fuller understanding of the processes and situations that cause faults, wear and tear, and the need for repairs. They should, with this knowledge, be able to use manufacturers' service manuals or websites to specify replacement parts. Classroom notes would provide suitable evidence as would evidence of researching manufacturers, websites or service manuals.

For D1, learners must show they understand the range of relevant legislation and codes of practice that relate to the operation of land-based machinery. Suitably annotated internet research together with classroom notes would provide evidence for this.

For D2, learners should evaluate the safe and effective use of selected land-based machines for given situations. Assessment could be based on the evidence produced for M3 and M4. Evidence could take the form of notes from tutor- led discussions or question and answer sessions.

D3 requires learners to examine the range and suitability of options for the repair and servicing of specified land-based machines. Specifically they should know the cost effectiveness of in-house or commercially available servicing and repairs. Assessment could be through a presentation or notes of classroom discussions and lectures.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1, D1	Land-based Machinery: the framework	You have been asked to produce a employee booklet to show the range of commonly used land-based machines. You must include examples of different operating systems and the legal framework within which they can be safely used.	Completed employee booklet.

Criteria covered	Assignment title	Scenario	Assessment method
P3, P4, P5, P6, M2, M3, M4, D2	Land-based Machine Operation	You have been asked to demonstrate a range of practical skills using land-based machinery safely.	Practical observation records. Logbook.
P7, P8, M5, D3	Land-based Machine Maintenance and Repair	You must carry out routine and non-routine maintenance and repair for two given land-based machines.	Practical observation records. Logbook.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Land-based sector suite. This unit has particular links with:

Level 2	Level 3
Introduction to Land-based Machinery Operation	Undertake and Review Work Experience in the Land-based Industries

Essential resources

Learners must have access to a range of land-based machinery, including motor or drive units, together with a variety of suitable attachments. Learners must also be able to demonstrate their practical skills over varied terrain and conditions. Ideally, both the variety of machines and terrain should be readily available but could be supplemented by off-site visits. Workshop tools, equipment and servicing parts are also required.

Employer engagement and vocational contexts

Most rural industries use land-based machinery, and therefore there are a number of opportunities for employer engagement. However, tutors must be satisfied that the level of supervision and learner skill is sufficient for learner experience to be safe and meaningful.

Indicative reading for learners

Textbooks

Balls R – *Horticultural Engineering Technology: Field Machinery* (Palgrave Macmillan, 1985) 978-0333364345

Bell B – *Farm Machinery* (Old Pond Publishing, 2008) ISBN 978-1903366684

Bell B and Cousins S – *Machinery for Horticulture, 2nd Edition* (Old Pond Publishing, 1997) ISBN 0852363699

Culpin C – *Farm Machinery, 12th Edition* (Blackwell Science, 1992) ISBN 978-0632031597

Landers A – *Farm Machinery* (Farming Press, 2002) ISBN 978-0852365403

Journals

Amenity Machinery and Equipment

Amenity Management

Farmers Weekly

Horticulture Weekly

Turf

Websites

www.agmachine.com	The Global Information Directory for Agricultural Machinery and Farm Equipment
www.hse.gov.uk	Health and Safety Executive

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	investigating how to prepare different land-based machinery
Creative thinkers	comparing land-based machines
Team workers	collaborating with colleagues in assessing potential machinery faults and/or defective parts
Self-managers	operating land-based machinery and assessing the risk to themselves and others locating faults and prioritising maintenance
Effective participators	carrying out a sequence of steps for pre-start checks on land-based machinery.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	researching and evaluating information to order parts
Creative thinkers	adapting operating procedures according to conditions
Reflective learners	familiarising themselves with land-based machinery operations
Team workers	working with others in the maintenance of land-based machinery
Self-managers	managing their time in the maintenance of land-based machinery.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	maintaining computer-based maintenance records and stock levels
Follow and understand the need for safety and security practices	
Troubleshoot	
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	researching codes of practice and legal requirements for operating land-based machinery
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	searching for parts codes for land-based machinery using manufacturers' databases
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	maintaining maintenance and servicing records
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	producing a catalogue of land-based machinery
Evaluate the selection and use of ICT tools and facilities used to present information	
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	
Identify the situation or problem and the mathematical methods needed to tackle it	making up fuel mixes for land-based machinery ordering fluid quantities for servicing purposes

Skill	When learners are ...
Select and apply a range of skills to find solutions	
Use appropriate checking procedures and evaluate their effectiveness at each stage	
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	
Draw conclusions and provide mathematical justifications	
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	discussing similarities and differences between land-based machines
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	producing a manual of land-based machinery.