Unit 25: Understanding and Servicing Land-based Harvesting Machinery (Processing)

Unit code: D/601/4260

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to the skills and knowledge in land-based harvesting machinery and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

Unit introduction

Modern land-based practices dictate that harvest periods are intensive operations.

Manufacturers have developed harvesting machinery that is complex in design yet reliable and effective in operation. Those employed in the maintenance, fault diagnosis, operation and repair of harvesting machinery must have the knowledge and skills to undertake potentially costly and complex repair activities.

In this unit learners will develop the knowledge and skills needed to understand the processing principles of harvesting machinery. Health, safety and sustainability issues encountered when carrying out service and repair activities will be stressed during the delivery of this unit.

Learning outcomes

On completion of this unit a learner should:

1 Understand the principles of crop processing in land-based harvesting machinery

2 Be able to carry out 'preparation for work' procedures on crop processing mechanisms in harvesting machinery

3 Be able to carry out maintenance, repair and 'out of season' lay up procedures on crop processing mechanisms in harvesting machinery

4 Understand the 'control of' and specification of crop processing mechanisms in harvesting machinery.

Unit content

1 Understand the principles of crop processing in land-based harvesting machinery

Processing system principles: threshing (peg drum, rasp bar drum); stripping; cutting; separation (rotary drum, straw walker, tined rotor); packing (ram, fixed chamber, variable chamber); packaging (twine wrap, net wrap, plastic wrap, knot formation)

Cleaning system principles: sieve; blower/fans; vibrating; reciprocating; rotary; gravity; brush; cyclone; roller table; contra-rotating roller; duplex web; fixed web; grading equipment; crop dryers

2 Be able to carry out 'preparation for work' procedures on crop processing mechanisms in harvesting machinery

Workshop settings: manufacturers' manuals and data; drive-line; height; speed; levels; operation of controls; timing of components; alignment; density; screen size; air flow; wrap requirements and settings; twine settings; health and safety; risk assessment; personal protective equipment (PPE); relevant, current legislation eg Health and Safety at Work Act 1974, Control of Substances Hazardous to Health Regulations 2002 (COSHH)

Operation settings: height; levels; alignment; speed; material flow; density; screen adjustment; air flow; bale size; wrap setting; damage assessment; loss monitor; health and safety; risk assessment; PPE; relevant current legislation

3 Be able to carry out maintenance, repair and 'out of season lay up' procedures on crop processing mechanisms in harvesting machinery

Pre-season: inspection procedures; compliance with legislation; compliance with manufacturers' specifications; lubrication; common causes of component and assembly failure; repair procedures eg replacement of worn components; safe practices, clearances settings; spring pressures; timing; health and safety; risk assessment; PPE; relevant current legislation

Post-season: eg corrosion protection; common causes of component and assembly failure; identification of worn components; cleaning; health and safety; risk assessment; PPE; relevant, current legislation

4 Understand the control of and specification of crop processing mechanisms in harvesting machinery

Work rates: spot; effective; field efficiency; factors affecting efficiency; material volume limitations; material losses; loss control; appropriate calculations

Specification: spacing; width; material capacity; options; speeds; electronic monitoring; hydraulic controls; machine protection devices; costs

Machine compatibility: uses; sequence in field operations; rows; power requirement; operational limitations; condition/quantity of material input; suitability for different crop and surface conditions

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 assessment 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 principles of crop processing in harvesting machinery	**M1** select a range of crop processing mechanism settings to accommodate two contrasting crops	**D1** compare the crop processing mechanisms of different manufacturers in terms of automatic adjustment
P2 explain how processing mechanisms accommodate varying crops and crop conditions [IE]		
P3 carry out adjustments to enable crop processing mechanisms to give optimal performance in a range of crops and crop conditions [SM, TW]	**M2** explain the changes to 'crop flow' as a result of adjustments to crop processing mechanisms	**D2** evaluate a range of 'fast wearing' crop processing components and prescribe actions to make them 'fit for purpose'.
P4 carry out maintenance procedures on crop processing mechanisms [SM, TW]	**M3** plan maintenance procedures for crop processing mechanisms indicating the expected service life of 'fast wearing' components.	
P5 carry out procedures to identify and rectify faults on crop processing mechanisms		
P6 carry out 'out of season lay up' procedures to crop processing mechanisms		
P7 explain the operator control procedures of crop processing mechanisms		
P8 explain the specification data of crop processing mechanisms. [IE, RL, EP]		

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 and theory sessions, visits to observe 'in field' machine operation will enhance learner understanding.

Tutors delivering this unit have opportunities to use as wide a range of teaching and learning techniques, for example lectures, discussions, seminar presentations, site visits, supervised harvesting machinery practicals. Research using the internet and/or library resources and the participation in work experience would enhance the learning experience.

Delivery should stimulate, motivate, educate and enthuse learners. Work placements should be monitored regularly in order to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit before any work-related activities, so that naturally occurring evidence can be collected at the time.

For example, learners may have the opportunity to prepare processing mechanisms in harvesting machinery for operational activities, and they should be encouraged to ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Health and safety issues relating to working in the field and in repair workshops must be stressed and reinforced regularly, and risk assessments must be undertaken before practical activities.

Tutors should consider integrating the delivery, private study and assessment of this unit with other relevant units.

Learning outcomes 1 and 4 are directly linked and are likely to be delivered through formal lectures, discussion, supervised harvesting machinery practicals, site visits and independent learner research. Learners will be aware of the broad range of harvesting machines and their uses. Visiting speakers could add to the relevance of the subject. For example, representatives from manufacturers or importers could talk about their equipment and its features.

Learning outcomes 2 and 3 develop the skills a land-based service.

Technician needs to maintain and repair processing mechanisms in harvesting machinery. Delivery techniques should be varied and can be linked to the delivery of learning outcomes 1 and 4. It is expected that practical activities will form a major part of the delivery of these learning outcomes. Visiting speakers could add to the relevance of the subject. For example, land-based machinery technicians or workshop managers could talk about their work and the techniques they use. Learners would benefit from operating the equipment themselves or seeing the equipment working in real environments.

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: Processing Mechanism Functions (P1, P2, M1, M2)
Understanding the function of processing mechanisms, and how the components can be adjusted to accommodate a range of crops and crop conditions.
Understanding the drivelines to processing mechanisms.
Understanding of the reasons why a range of adjustments are necessary in processing mechanisms.
Assignment 2: Processing Mechanism Maintenance and Repair (P3, P4, P5, P6, D2)
Show competence in preparing processing mechanisms of harvest machinery to enable efficient and effective harvesting.
Show competence in maintaining processing mechanisms of harvest machines in a fit for purpose condition.
Show competence in identifying and rectifying faults in processing mechanisms of harvest machines.
Show competence in preparing processing mechanisms for out of season storage.
Show competence in determining the condition of components in processing mechanisms.
Assignment 3: Operating of Processing Mechanisms (P7, P8, M3, D1)
Understanding the control mechanisms used to make adjustments to processing mechanisms as a result of differing crops and crop conditions.
Understanding the data that recommends settings for different crops.

Assessment

Tutors should identify the harvest machinery through discussion with learners. Where possible, to ensure fairness of assessment the size and complexity of the assessment should be the same for all learners. Learners are expected to provide evidence for at least one cereal, one forage and one root harvesting machine.

P1 and P2 require learners to explain the principles of processing mechanisms in harvesting machines and how they accommodate various crops and crop conditions. This could be assessed directly by the tutor during practical activities.

If this format is used then suitable evidence from guided activities would be observation records completed by the tutor, and accompanied by appropriate work-logs or other relevant learner notes. If assessed during a work placement, witness statements should be provided by a suitable representative and verified by the tutor.

Alternatively, evidence for this could take the form of a pictorial presentation with notes (possibly using appropriate presentation software), or a written assignment.

P3, P5 and P6 require learners to prepare and use selected processing mechanisms in harvesting machinery to meet given crops and crop conditions. The tutor should identify the machines most appropriate to learners, which may be influenced by the agricultural activity in their region. The machines may be the same as those used to provide evidence for other grading criteria. Health, safety and environmental considerations are important.

P4 requires learners to maintain and repair processing mechanisms in harvesting machinery. The tutor should identify the machines most appropriate to learners, which may be influenced by the agricultural activity in their region. The machines may be the same as those used to provide evidence for other grading criteria. Health, safety and environmental considerations are important.

P7 and P8 require learners to provide information on control procedures and the performance and specification of selected processing mechanisms in harvesting machinery. Tutors should identify the machines and agree them with learners. The machines may be the same as that used to provide evidence for other grading criteria.

Learners are required to interpret machine operator manuals and specifications to enable effective and efficient harvesting. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software), an annotated poster or a written assignment.

M1 requires learners to determine the most appropriate settings for the processing mechanisms of harvest machinery to achieve maximum efficiency and effectiveness of the harvesting operation. Tutors should identify the machines and agree them with learners. The machines may be the same as those used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

M2 requires learners to explain the impact changing crop conditions has on crop flow through processing mechanisms of harvesting machines and how mechanism adjustments accommodate these to maintain maximum efficiency and effectiveness of the harvesting operation. Tutors should identify the machines and crop conditions and agree them with learners. The machinery may be the same as that used to provide evidence for other grading criteria. Evidence could be in the same form as for P1.

M3 requires learners to plan routine maintenance procedures for processing mechanisms of harvest machinery and identify the components which would most likely to fail due to normal 'wear and tear' and damage due to unwanted objects (for example rocks) entering the machine. Evidence could be in the same form as P1

D1 requires learners to compare the automatic adjustment systems of processing mechanisms on harvesting machines which contribute to maximum efficiency and effectiveness of the harvesting operation. Evidence could be in the same form as for P1.

D2 requires learners to evaluate components in processing mechanisms to establish if they are fit for purpose. The components should be a mixture of wearing ones and non-wearing ones that may be subject to damage. Learners are required to suggest appropriate rectification strategies. Evidence could be in the same form as for P1.

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, M2	Processing Mechanism Functions	A report compiled from information obtained from a number of sources showing the understanding a service technician needs to make valid judgements to ensure effective and efficient harvesting can be achieved.	Written report. Verbal presentation.
P3, P4, P5, P6, D2	Processing Mechanism Maintenance and Repair	A simulated practical assessment displaying competence of maintenance and repair procedures.	Observation. Direct questioning. Written report.
P7, P8, M3, D1	Operating of Processing Mechanisms	A report compiled, using current harvest machinery, on how the harvest machine operator control and interpret the crop settings.	Written report. Verbal presentation.

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
Service and Repair Land-based Harvesting and Processing Equipment	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)
LEO4 Core Land-based Engineering Principles – Mechanical Principles	
LEO5 Core Land-based Engineering Principles – Tools and Equipment	
LEO8 Core Land-based Engineering Principles – Servicing and Maintenance	

Essential resources

Learners will need access to a range of processing harvesting machinery and relevant attachments, simulation equipment to support practical investigation and sufficient test and repair equipment and materials to enable accurate evaluation of machinery, assemblies and components.

Manufacturers' service manuals and test data will make a significant contribution to learner achievement.

Tutors delivering this unit should be familiar with current cutting and lifting harvesting machinery.

Employer engagement and vocational contexts

This unit focuses on the development of skills and understanding service engineers need to maintain processing mechanisms of harvesting machinery, and will give learners the background to carry out these activities safely and with consideration for the environment. Centres are encouraged to create and further develop links with practising land-based service engineers and managers to help learners develop their confidence when applying new skills and knowledge. This could be via site visits, works experience, guest speakers, seminars and coaching sessions.

Indicative reading for learners

Textbooks

Bell B – *Farm Machinery (Resource Management), 5th Edition* (Old Pond Publishing, 2005) ISBN 1903366682

Hillier V and Coombes P – *Hillier's Fundamentals of Motor Vehicle Technology, 5th Edition* (Nelson Thornes, 2004) ISBN 0748780823

Whipp J and Brooks R – *Transmission, Chassis and Related Systems (Vehicle Maintenance & Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X

Journals

Farmers Guardian

Farmers Weekly

Profi International

Websites

www.bagma.com	British Agricultural and Garden Machinery Association
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.howstuffworks.com	HowStuffWorks
www.hse.gov.uk	Health and Safety Executive
www.iagre.org	Institution of Agricultural Engineers
www.lantra.co.uk	Lantra Sector Skills Council

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	producing evidence to support their understanding of the principles of operation of cutting and lifting mechanisms, and the operator controls and machine data manuals
Reflective learners	preparing evidence for their explanation of the impact on crop flow as a result of mechanism adjustment
Team workers	carrying out practical tasks to adjust and maintain mechanisms by communicating with customers, suppliers, line managers and colleagues
Self-managers	carrying out practical tasks to adjust and maintain mechanisms by communicating with customers, suppliers, line managers and colleagues
Effective participators	preparing evidence for their explanation of the impact on crop flow as a result of mechanism adjustment.

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 information to create 'risk assessments' for the service and maintenance tasks
Creative thinkers	applying engineering skills to the maintenance and repair of mechanisms
Reflective learners	analysing components of the mechanisms to determine their 'fitness for purpose' condition
Team workers	gathering information and demonstrating skills competence
Self-managers	completing tasks on time
Effective participators	supporting fellow learners in information gathering, skills development and task completion.

Functional Skills – Level 2

Skill	When learners are ...
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	designing a presentation on the functions of processing mechanisms
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	using data to determine settings for different crops
Identify the situation or problem and the mathematical methods needed to tackle it	
Select and apply a range of skills to find solutions	
Use appropriate checking procedures and evaluate their effectiveness at each stage	
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	delivering a presentation on the functions of processing mechanisms
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading a range of sources on the functions of processing mechanisms
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	producing a report on the functions of processing mechanisms producing a report on operating processing mechanisms.