

Unit 26: Working with Land-based Construction Plant Materials Handling Equipment

Unit code:	Y/601/4287
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 understanding in land-based construction plant materials handling equipment 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

The need to handle material in an efficient manner and improve the productivity of land-based industries have become important as businesses analyse their operational costs. To reduce costs and improve efficiency manufacturers have developed machines that, while often complex in design, are universal in application, offering reliability and ease of operation. Technicians employed in the maintenance, fault diagnosis and repair of this equipment must have the knowledge and skills to undertake potentially costly and complex repair activities.

This unit gives learners the opportunity to study construction plant materials handling equipment used in the land-based industries. The unit covers health and safety issues encountered when carrying out related service and repair activities.

Learners will develop an understanding of construction plant materials handling equipment and their assemblies, and also the skills to identify faults and carry out repairs to them.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand the function and specification of construction plant materials handling equipment
- 2 Understand the principles of operation of construction plant materials handling equipment
- 3 Be able to carry out maintenance to construction plant materials handling equipment
- 4 Be able to carry out fault diagnosis and repair to construction plant materials handling equipment.

Unit content

1 Understand the function and specification of construction plant materials handling equipment

Function and capabilities of materials handling equipment: excavators; back hoe loaders; telescopic handlers; mast forklifts; articulated loading shovels; tracked loading shovels; skid steer loaders; dumpers; conveyors; working principles; layout of components

2 Understand the principles of operation of construction plant materials handling equipment

Tyres, tracks and running gear: tyres; rubber and steel tracks; sprockets; idlers; rollers

Steering systems: types of steering modes (articulated steering, skid steer, tracked steering)

Transmission systems: hydrostatic; powershift; powershuttle; pre-select

Hydraulic systems: open and closed centre, digging; loading

3 Be able to carry out maintenance to construction plant materials handling equipment

Maintenance: reasons for maintenance and servicing; use of manufacturers' service manuals and data; pre-use maintenance (complete service, workshop adjustments, security of fixtures and fastenings); in-use maintenance (daily pre-start checks and lubrication, operational/site adjustments); post-use maintenance (corrosion protection, replacement of worn parts, storage procedures); strategies (proactive, predictive/periodic and continuous, replacement); maintenance practices eg on-board condition monitoring; costs

Health and safety: personal protective equipment (PPE); risk assessments; relevant current legislation eg Health and Safety at Work etc Act 1974, Control of Substances Hazardous to Health Regulations 2002 (COSHH); Provision and Use of Work Equipment Regulations 1998 (PUWER), Lifting Operations and Lifting Equipment Regulations 1998 (LOLER); environmental management of maintenance activities

4 Be able to carry out fault diagnosis and repair to construction plant materials handling equipment

Information gathering and evaluation: sources eg question operator, perform diagnostic tests; access service data/workshop manuals; use of fault-finding charts; used oil analysis

Repair procedures: replacement; overhaul; costs; performance (manufacturers' specifications and customer requirements); methods used to test systems and/or identify faulty components eg visual, road test, electronic, operator questioning; common causes of component and system failure
Assessment and grading criteria

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 function of construction plant materials handling equipment [IE, CT, RL]	M1 compare the capabilities of construction plant materials handling equipment to meet given operational objectives	D1 evaluate transmission, steering and hydraulic systems available for use in materials handling equipment	
P2 explain the specifications of construction plant materials handling equipment			
P3 outline the layout of key working components and assemblies of given specialist construction plant materials handling equipment			
P4 explain principles of lifting mechanisms of materials handling equipment	M2 compare the layout of the main working components and assemblies of lifting mechanisms compared to handling mechanisms of materials handling equipment		
P5 explain principles of handling mechanisms of materials handling equipment			
P6 carry out maintenance to lifting and handling mechanisms of construction plant materials handling equipment [TW, SM, EP]	M3 discuss typical in-use and post-use maintenance requirements for selected materials handling equipment		D2 evaluate diagnostic and repair activities carried out on materials handling equipment making appropriate recommendations for improvement.
P7 carry out appropriate risk assessment for given procedures			
P8 carry out (using manufacturer's recommendations) fault diagnosis and repair to lifting and handling mechanisms of materials handling equipment			
P9 describe fault diagnosis and repairs carried out.	M4 explain the common causes of component failure in materials handling equipment.		

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 industrial experience placements.

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised workshop activities, practicals, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable. 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 repair a piece of plant materials handling equipment 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.

Whichever delivery methods are used, it is essential that tutors stress the importance of sound environmental management and the need to manage equipment using legal methods.

Health and safety issues relating to workshop situations must be stressed and reinforced regularly, and risk assessments must be undertaken before practical activities. Adequate PPE must be provided and used following the production of suitable risk assessments.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

Learning outcomes 1 and 2 cover the theoretical aspects of plant materials handling equipment. They are likely to be delivered through formal lectures, discussion, possible site visits, demonstration and supervised practical sessions and independent learner research.

Learning outcomes 3 and 4 look at the maintenance, fault diagnosis and repair of plants materials handling equipment. These can be delivered as individual practical sessions as well as formal lectures and discussions. Health and safety within the workshop must be paramount at all times.

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 to the unit.

Assignment 1: The Function and Specification of Construction Plant Materials Handling Equipment (P1, P2, P3, M1, D1)

Introduction to the assignment and learner-centred research.

Topic and suggested assignments/activities and/assessment

The function and specification of plant materials handling equipment – how they work and their capabilities.

Assignment 2: Understand the Principles of Operation of Construction Plant Materials Handling Equipment (P4, P5, M2)

Introduction to the assignment and learner-centred research.

The principle of operation of material handling equipment – how the equipment is operated and its limits.

Assignment 3: Carry out Maintenance to Construction Plant Materials Handling Equipment (P6, P7, M3)

Introduction to the assignment and learner-centred practical.

Carry out maintenance activities on plant materials handling equipment.

Assignment 4: Carry out Fault Diagnosis and Repair to Construction Plant Materials Handling Equipment (P8, P9, M4, D2)

Introduction to the assignment and learner-centred practical.

Carry out fault diagnosis and repair on plant materials handling equipment.

Unit review.

Assessment

For P1, learners must explain the function of construction plant materials handling equipment. Tutors should identify the machines or agree them through discussion with learners. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine, preferably those commonly used in the land-based industry sector that is the learners' primary interest area.

P2 learners must explain the specifications of construction plant materials handling equipment. Tutors should identify the machines or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine, preferably those commonly used in the land-based industry sector that is the learners' primary interest area.

For P3, learners must outline the layout of key working components and assemblies of construction plant materials handling equipment. Tutors should identify the machines or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or a written assignment.

P4 and P5 cover the principles of operation of lifting and handling mechanisms. Tutors should identify the machines or agree them through discussion with learners. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for one lifting and handling mechanism. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or a written assignment.

P6 requires learners to carry out maintenance procedures on construction plant materials handling equipment to meet given objectives. Tutors should identify the machines and objectives, or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading

criteria. Where possible, to ensure fairness of assessment the size and complexity of the tasks should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for two types of machine, preferably those commonly used in the land-based industry sector that is the learners' primary interest area.

For P7, learners must carry out risk assessments for given maintenance procedures on selected specialist construction plant materials handling equipment. Learners are expected to provide evidence for two maintenance procedures. Tutors should identify the machines and the procedures or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. Evidence should be in a format that is recognised within the industry and by the Health and Safety Executive.

P8 and P9 learners must describe how to and carry out (using manufacturers' recommendations) fault diagnosis and repair procedures on construction plant materials handling equipment. Tutors should identify the machines and procedures, or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the tasks should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for two types of machine, preferably those commonly used in the land-based industry sector that is the learners' primary interest area.

For M1, learners need to compare the capabilities of construction plant materials handling equipment to meet given operational objectives. Tutors should identify the machines and objectives, or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the tasks should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine.

For M2, learners must discuss the layout of the main working components and assemblies of plant materials handling equipment. Tutors should identify the machines or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster or a written assignment.

M3 requires learners to discuss typical in-use and post-use maintenance requirements for construction plant materials handling equipment. Tutors should identify the machines and objectives, or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the tasks should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for three types of machine.

For M4, learners are required to explain the common causes of component failure in construction plant materials handling equipment. Tutors should identify the machines or agree them through discussion with learners. The machines may be the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the task should be the same for all learners. Learners are expected to give evidence for at least two different machines.

For D1, learners need to evaluate transmission, steering and hydraulic systems available for use in construction plant materials handling equipment. Learners should include in their evidence all the types of transmission, steering and hydraulic systems listed in the unit content.

For D2, learners are required to evaluate selected diagnostic and repair activities carried out on construction plant materials handling equipment and make appropriate recommendations for improvement. Tutors should identify the machines and activities, or agree them through discussion with learners. The machines may be

the same as those used to provide evidence for other grading criteria. Where possible, to ensure fairness of assessment the size and complexity of the tasks should be the same for all learners. It is expected that, as a minimum, learners will provide evidence for two diagnostic and repair activities.

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,P3,M1, D1	Function and Specification of Construction Plant Materials Handling Equipment	You are working for a local plant hire company, whilst working on the hire desk you will need to understand the function of construction plant material handling equipment used in the land-based industries.	Assignment/report. Presentation.
P4, P5, M2	Understand the Principles of Operation of Construction Plant Materials Handling Equipment	You are working for a local plant hire company, whilst working as a mobile repair technician you will need to understand the principles of operation of construction plant materials handling equipment used in the land-based industries.	Assignment/report. Presentation.
P6, P7, M3	Carry out Maintenance to Construction Plant Material Handling Equipment	You are working for a local plant hire company, whilst working as a service technician you will need to maintain a range of construction plant materials handling equipment, demonstrating your ability to work in a safe manner.	Practical. Report/job card/work logs.
P8, P9, M4, D2	Carry out Fault Diagnosis and Repair to Construction Plant Material Handling Equipment	You are working for a local plant hire company, whilst working as a service technician you will need to diagnose faults and carry out repairs to a range of construction plant materials handling equipment, demonstrating your ability to work in a safe manner.	Practical. Report/job card/work logs.

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
Undertake Work Related Experience in the Land-based Industries	Working with Land-based Construction Plant Ground Engaging And Consolidation Equipment
LEO4 Core Land-based Engineering Principles – Mechanical Principles	

Level 2	Level 3
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 ground engaging and consolidation construction plant equipment to support practical investigation. They will also need access to 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 learners' achievement of the learning outcomes. Tutors delivering this unit should be familiar with current plant materials handling equipment.

Employer engagement and vocational contexts

Learners could be introduced to a variety of professionals from different companies and organisations to broaden their knowledge and make the learning experience interesting and contextualised. This could be through guest lectures, work placements or off-site visits to different establishments.

If assessed during a 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 software or an overhead projector), an annotated poster or a written assignment.

Indicative reading for learners

Textbooks

Edwards D, Harris F and McCaffer R – *Management of Off-highway Plant and Equipment* (Routledge, 2003) ISBN 0415251281

Harris F – *Modern Construction and Ground Engineering Equipment and Methods, 2nd Edition* (Prentice Hall, 1994) ISBN 0582236576

Huzij R, Spano A, Bennett S – *Modern Diesel Technology: Heavy Equipment Systems* (Delmar Cengage Learning, 2006) ISBN -13: 978-1-4180-0950-2

Nunney M J— *Light and Heavy Vehicle Technology, 4th Edition* (Butterworth-Heinemann Ltd, 1998) ISBN 0750680377

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	explaining the function and specification of machinery assessing risk explaining principles of operation
Creative thinkers	explaining the function and specification of machinery assessing risk explaining principles of operation discussing the correct selection of machinery
Reflective learners	discussing the correct selection of machinery describing methods of fault diagnosis
Team workers	planning and carrying out maintenance and repair work diagnosing faults using a variety of sources
Self-managers	planning and carrying out maintenance and repair work diagnosing faults using a variety of sources
Effective participators	diagnosing faults using a variety of sources.

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	planning and carrying out research activities related to the unit evaluating and carrying out extended thinking
Creative thinkers	asking questions to extend their thinking during lectures and practical sessions adapting ideas as circumstances change eg fault diagnosis on a variety of machinery
Reflective learners	identifying opportunities for their own achievements setting goals for themselves eg time management reviewing progress in practical tasks and coursework
Team workers	working with others to carry out repair and maintenance tasks reaching clear agreements regarding who is carrying out which tasks during practical activities working together when diagnosing faults
Self-managers	dealing with pressures in an emergency situation managing time and resources during practical activities
Effective participators	discussing issues of concern relating to time management and resources during practical activities identifying improvements that could be implemented during practical tasks.

● 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	completing their course work using ICT facilities using interactive materials for teaching and learning researching subjects on the internet
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	
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	
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> ● text and tables ● images ● numbers ● records 	
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	
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	

Skill	When learners are ...
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	planning an activity and getting relevant information from relevant sources
Identify the situation or problem and the mathematical methods needed to tackle it	using this information to carry out multi-stage calculations to do with, amounts or sizes, scales or proportion and using formulae
Select and apply a range of skills to find solutions	interpreting the results of calculations, presenting findings and justifying methods
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	reading material on the subject from a variety of sources for their assignment work.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading around subjects and producing clear and concise documents using correct engineering terminology
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	presenting information to a group of people ideally in a classroom situation with their peers.