

Unit 34: Undertaking 4WD Vehicle Maintenance, Operation and Recovery

Unit code:	T/601/4281
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 working with 4WD vehicles 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

Four-wheel drive (4WD) vehicles play an integral role in many rural or land-based businesses. They have become essential parts of the everyday lives of many people involved in traditional land-based industries such as agriculture, forestry, countryside management and fishery management. The growing leisure sector, ranging from countryside tours to off-road trials, has also strengthened the need for this type of vehicle. The emergency services also use four-wheel drive vehicles in support of their rural activities.

Learners will look at common four-wheel drive vehicle specifications and non-standard features and need to understand the specifications and key features which set four-wheel drive vehicles apart from more conventional road going vehicles.

This unit involves the operation and maintenance of common four-wheel drive vehicles. At a practical level, learners will use manufacturers' manuals and data to ensure that they understand the maintenance requirements of a four-wheel drive vehicle. They will look at the operation of these vehicles over varying land conditions as they learn the relevant capabilities of the machines and will focus on recovery techniques used with four-wheel drive vehicles, in varying situations.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand common features and specifications of a 4WD vehicle
- 2 Be able to carry out routine maintenance of a 4WD vehicle
- 3 Be able to operate a 4WD vehicle in varying land conditions
- 4 Be able to recover a 4WD vehicle.

Unit content

1 Understand common features and specifications of a 4WD vehicle

Specifications: engine, suspension (parabolic springing, air suspension), steering, brakes, off-road capability, dimensions, weight, performance, fuel economy; traction aids (viscous couplings, electronic traction control, multi-plate transfer (MPT), hill descent control (HDC), pneumatic-locking differentials); attachments; operator facilities

2 Be able to carry out routine maintenance of a 4WD vehicle

Maintenance: cleaning; manufacturers' recommendations and service schedules; pre-start checks; tyres (selection, care, pressures); lubrication; fuel; battery; security and maintenance of fixtures and fittings eg winches, seats, safety belts; common causes of component failure; maintenance and component failure prevention strategies; health and safety; risk assessment; relevant current legislation and codes of practice

3 Be able to operate a 4WD vehicle in varying land conditions

Instrumentation and controls: position and use of; warning lights; isolators; steering wheel; controls; mirrors; vehicle handbooks

Surveying the ground: features and conditions eg softness, wetness, soil type, rutted, rough, angle of slope

Maintaining traction: technique eg use of gears, use of brakes, engine revs, tyre specification and pressures, traction aids

Ground clearance: approach angle; departure angle; ramp breakover angle; articulation

Gears: selection and use eg auto/manual, centre differential lock, range selection, 2WD/4WD, starting in gear

Gradients: gear selection; reversing; starting and stopping; ascending and descending

Side slopes: angle of slope; gear selection; obstacles; load distribution

Wading/fording: preparation eg snorkels, wading plugs, radiator protection, identification of water depth and obstacles; effects of bow waves, gear selection

Environmental protection: methods eg elimination of wheel spin, country code, respect for nature, litter, rights of way, pollution prevention; relevant current legislation; respect for others and the environment

4 Be able to recover a 4WD vehicle

Techniques: towing; jacking; winching; safety; signalling; environmental protection

Equipment and its use: winches (mechanical, electric, hydraulic, capstan); simple traction aids; high-lift jacks; kinetic recovery straps; anchors; anchor points; tow ropes/straps/chains; shackles; protective strops; snatch blocks; shovels; sand ladders; health and safety; risk assessment; personal protective equipment (PPE)

Winch selection: maximum line pull; stall rating; duty cycle; vehicle electrical system preparation; mounting points

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 features and specifications of a 4WD vehicle	M1 evaluate traction aids used on 4WD vehicles	D1 explain common causes of component failure in a selected 4WD vehicle and recommend appropriate methods of preventing their failure	
P2 discuss situations where these features would be used [SM]			
P3 assess the condition of a 4WD vehicle [IE]	M2 prepare and justify maintenance schedules for selected 4WD vehicles		
P4 carry out routine maintenance of a 4WD vehicle according to manufacturer's instructions [TW]			
P5 review the extent to which the features of a 4WD vehicle enable it to operate in off-road situations [CT]	M3 explain factors that will affect a 4WD vehicle's operational ability on selected terrains		D2 evaluate different operational techniques that could be used to ensure safe passage in given situations in a selected 4WD vehicle.
P6 safely operate a 4WD vehicle in on and off-road situations [TW]			
P7 review options for recovering 4WD vehicles from typical situations	M4 explain the function and operation of commonly used 4WD recovery equipment.		
P8 safely recover a 4WD vehicle. [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 assessments, written assessment, visits to suitable collections and will link to industrial experience placements.

Four-wheel drive vehicles are essentially designed for off-road use and use in difficult terrains. Learners should consider the features that vehicles need to enable them to perform in these conditions, and then reflect on the approaches manufacturers use to develop these features. Learners need to consider the specifications of given four-wheel drive vehicles so that they can understand the potential and limitations of the vehicles. They need to be aware of the methods used to improve traction, and when these could be used. Learners would benefit from having the opportunity to see and experience the range of features manufacturers use to improve the performance of their vehicles. Visits to suppliers and dealers would be helpful in this context as would presentations from sales or service professionals.

Learners need to assess a four-wheel drive vehicle for signs of wear and damage and operate it within the relevant legal framework. They need to understand manufacturers' instruction manuals to plan and undertake routine maintenance. Learners should be aware of common causes of component failure in a selected 4WD vehicle, understand the causes and be able to recommend appropriate methods of preventing failure. General workshop health and safety measures will need to be reinforced alongside the more specific health and safety associated with maintenance procedures. Risk assessments must be undertaken before commencing any practical activities.

This unit has a strong practical focus and learners will need opportunities to practise driving and recovering a four-wheel drive vehicle in a range of suitable conditions, for example steep slopes, standing water, mud. Learners need to understand the function and operation of commonly used 4WD recovery equipment. They need to understand the factors that will affect a 4WD vehicle's operational ability over selected terrains and assess the operational techniques that could be used to ensure safe passage for a selected 4WD vehicle in given situations.

Learners need to be familiar with a range of recovery methods and to be able to select the most appropriate method for given situations. When engaging in vehicle recovery activities, tutors need to be mindful of health and safety and take into account driving licences and entitlements.

The use of visiting speakers who have experience of driving and recovering 4WD vehicles, for example forestry workers, countryside rangers, search and rescue personnel, will help learners put the use, capabilities and limitations of these vehicles in perspective.

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: Vehicle Specifications and Features (P1, P2, M1)
Tutor introduces the assignment brief.
Specifications and features – definition, examples of use from common types of four-wheel drive vehicle.
Relating specification to purpose and use.
Assignment 2: Vehicle Maintenance (P3, P4, M2, D1)
Tutor introduces the assignment brief.
Health and safety and risk assessment.
Checking condition of a four-wheel drive vehicle.
Carrying out routine maintenance.
Signs and causes of wear/part failure.
Assignment 3: Four-wheel Drive Vehicle Operation (P5, P6, M3, D2)
Tutor introduces the assignment brief.
Risk assessments and health and safety.
Instrumentation and controls.
Surveying the ground.
Safe vehicle operation in a range of conditions and terrains.
Assignment 4: Four-wheel Drive Vehicle Recovery (P7, P8, M4)
Tutor introduces the assignment brief.
Risk assessments and health and safety.
Recovery techniques.
Selecting and using recovery equipment.
Use of winches.
Vehicle recovery.
Unit review.

Assessment

To pass this unit, learners need to be able to work with a variety of vehicles across a range of different circumstances. Tutors need to ensure fairness of assessment so that the size and complexity of the task are the same for all learners.

For P1 and P2, learners must describe the specifications and non-standard features of selected 4WD vehicles. They need to relate these features and specifications to the situations where these vehicles may be used so that learners can demonstrate an understanding of how these features enable these vehicles to operate safely in these conditions. Learners should start by considering one vehicle in detail, and then broaden this out to include other four-wheel drive vehicles used for a range of purposes.

For P3 and P4 learners must refer to manufacturers' instruction manuals and identify and carry out any routine maintenance work that is required. They also need to assess the vehicle for signs of wear and damage

P5 and P6 involve the use of a four-wheel drive vehicle in a range of conditions including both on and off-road. For P5, learners need to consider the terrain over which they will be operating, and review the features and specifications of the vehicle in relation to its ability to operate in these conditions. For P6, learners need to safely operate a four-wheel drive vehicle over varying land conditions to meet given objectives.

P7 and P8 relate to the recovery of a four-wheel drive vehicle. For P7, learners must know the main methods used to recover a vehicle, and explain the circumstances in which they would be used. For P8, learners need to put this information into practice by selecting the correct method to recover a four-wheel drive vehicle from a given situation.

For M1, learners must understand the operation of traction aids and evaluate the most appropriate traction aid for a given circumstance, and justify their selection.

For M2, learners should be able to build on the knowledge acquired in P4 by preparing and justifying a maintenance schedule for selected four-wheel drive vehicles. In addition to the work identified in the manufacturers' instructions, this should include areas identified as being subject to wear and damage identified in P3.

For M3, learners need to relate the features and specifications of a given four-wheel drive vehicle to its handling and functionality and its ability to work in selected terrains.

For M4, learners must explain the function and operation of commonly used equipment for the recovery of four-wheel drive vehicles and relate this information to the circumstances in which it would be most appropriate to use that equipment.

For D1, learners must take the component failure in P4, and explain the factors that contributed to the damage to these components. They also need to be able to recommend appropriate methods of preventing failure.

For D2, learners must build on the information in M3 by identifying the techniques that should be used to ensure safe passage for a selected four-wheel drive vehicle in given situations. They need to explain why these techniques were selected, how they should be used and justify their decisions.

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	Vehicle Specifications and Features	You are to prepare a poster itemising and describing the features and specifications of a given four-wheel drive vehicle.	Poster.
P3, P4, M2, D1	Vehicle Maintenance	You are required to assess the condition of a four-wheel drive vehicle, and carry out routine maintenance tasks.	Checklist.
P5, P6, M3, D2	Four-wheel Drive Vehicle Operation	You have to safely operate a given four-wheel drive vehicle in a range of situations.	Checklist.
P7, P8, M4	Four-wheel Drive Vehicle Recovery	You have a four-wheel drive vehicle which needs to be recovered. You have to consider the options, select and justify the most appropriate method and recover the vehicle.	Checklist and oral questioning.

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 links to most units in this specification and has particular links with:

Level 2	Level 3
Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment	Undertake and Review Work Related Experience in the Land-based Industries
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 4WD utility vehicles. As a minimum, this should include a typical utility 4WD vehicle, for example a Land Rover, and a quad bike or other all terrain vehicle (ATV). Workshop facilities suitable for maintaining 4WD vehicles will be required.

A range of varying land conditions to support practical activities will be required to include varying slopes, differing surfaces and water hazards. Access to specialist vehicle recovery equipment will be required including jacks, winches, anchors, chains, ropes, etc. Operator and workshop manuals, training videos and textbooks will make a significant contribution to learner achievement.

Tutors delivering this unit should be competent in the operation and recovery of 4WD vehicles. Regular technical updating of staff involved in delivery is essential.

Employer engagement and vocational contexts

This unit focuses on the practical and managerial aspects of the ownership and use of four-wheel drive vehicles and will give learners an understanding of how they underpin the skills needed to manage and operate these machines.

To enable learners to appreciate the range of four-wheel drive vehicles available, centres need to develop links with local machinery dealers and manufacturers. This could be achieved by visits to manufacturers, local shows and machinery dealerships or by the use of guest lecturers.

Indicative reading for learners

Textbooks

Cole N – *Off-road Recovery Techniques: A Practical Handbook on Principles and Use of Equipment* (Motor Racing Publications Ltd, 1996) ISBN 1 89987013X

Dimbleby N – *Off-road Driving Techniques* (The Crowood Press, 1997) ISBN 1 861260520

Hawker M and Keenlyside J – *Horticultural Machinery, 3rd Edition* (Longman Higher Education, 1985) ISBN 0582408075

Sheppard T – *Off-roader Driving* (Desert Winds, 1999) ISBN 0953232425

Websites

www.bagma.com

www.borda.org.uk

www.defra.gov.uk

www.howstuffworks.com

www.hse.gov.uk

www.iagre.org

www.lantra.co.uk

British Agricultural and Garden Machinery Association

British Off-Road Driving Association

Department for Environment, Food and Rural Affairs

How Stuff Works

Health and Safety Executive

Institution of Agricultural Engineers

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	justifying maintenance programmes for four-wheel drive vehicles
Creative thinkers	generating ideas for the safe recovery of a four-wheel drive vehicle
Reflective learners	assessing own performance in the operation of a four-wheel drive vehicle and identifying improvements
Team workers	working with colleagues to service and maintain a four-wheel drive vehicle
Self-managers	managing own time in preparing written course work
Effective participators	participating in class discussions.

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	supporting conclusions with reasoned arguments questioning and participating in visits or in response to presentations from guest lecturers carrying out internet research for coursework
Reflective learners	considering the feedback given on written course work and identifying areas that need further development
Self-managers	working towards goals when solving practical problems such as when manoeuvring four-wheel drive vehicles.
Effective participators	presenting a case of action for recovering a four-wheel drive vehicle.

● 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	using ICT to prepare written course work
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	saving and retrieving information held in an electronic format
Follow and understand the need for safety and security practices	protecting data from corruptions
Troubleshoot	
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	using the internet to identify common faults associated with specified four-wheel drive vehicles
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 	presenting information on maintenance schedules in tabular format presenting information on vehicle specifications pictorially
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	accessing vehicle maintenance schedules held on electronic format
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	preparing and justifying maintenance schedules for selected 4WD vehicles.

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	preparing and justifying maintenance schedules for selected 4WD vehicles.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading maintenance schedules for selected four-wheel drive vehicles to gather information on vehicle servicing and maintenance.
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	preparing written course work submissions.