



INSTITUTE
OF THE MOTOR
INDUSTRY

IMI QUALIFICATION



Assessment Criteria for

IMI Level 3 Certificate in Land- based Technology

I.D: 600/7793/1

*To be used in conjunction with Candidate Assessment Summary,
Practical Assessments and Written Assessments*

For assessor use only: Assessor Verifier Guidance

CENTRE INFORMATION

Please be aware that any **legislation** referred to in this qualification may be subject to amendment/s during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of and comply with any amendments, e.g. to health and safety legislation and employment practices.

Please be aware that **vehicle technologies** referred to in this qualification reflect current practice, but may be subject to amendment/s, updates and replacements during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of the latest developments and emerging technologies to ensure the currency of this qualification.

Please note: the relevance of the information contained in the **unit content** will vary depending upon the vehicle types being worked upon. The unit content is for guidance only and is not meant to be prescriptive.

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CONTACT SHEET

Learner Name:	
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Please complete as appropriate:	
Witness Name:	Witness Name:
Witness Job Title:	Witness Job Title:
Witness Signature:	Witness Signature:
Witness Name:	Witness Name:
Witness Job Title:	Witness Job Title:
Witness Signature:	Witness Signature:
Assessor Name:	Assessor Name:
Assessor Signature:	Assessor Signature:
Assessor Name:	
Assessor Signature:	
Internal Verifier Name:	Internal Verifier Name:
Internal Verifier Signature:	Internal Verifier Signature:



IMI Level 3 Certificate in Land-based Technology
I.D: 600/7793/1

In order to achieve the qualification, learners must achieve a minimum of 30 credits from any of the following units:

TQT = 300

Assessment Methodology

The assessment of these qualifications requires learners to successfully achieve a combination of practical, written, on-line assessments and observation by the learner’s assessor. (Simulation is allowable in some units - see statements below each unit’s evidence requirements.)

Note: Due to the nature of some units Centre Devised Assessments must also be used. These should follow the format used for other units and must be approved by the IMI Awards’ external verifier prior to issue to learners.

The table below clarifies which style of assessment/s are required for each unit:

- P = Practical Assessments
- W = Written Assessments
- T = On-line tests
- CDA = Centre Devised Assessments
- NA = Not Applicable

Unit Ref:	Unit Title and ID Number	GLH	Unit Level	Credit Value	Assessment		
					P	W	T
Group A: Optional Units (30 credits)							
LE0206	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes (A/600/3427)	60	2	10	M	M	M
LE0306	Land-based Engineering Operations – Service and Repair Engines and Components (H/600/3437)	60	3	10	M	M	M
LE0307	Service and Repair Suspension Systems on Land-based Equipment (K/600/3438)	30	3	5	M	M	M
LE0308	Maintain Electronic Control and Monitoring Systems on Land-based Equipment (M/600/3439)	60	3	10	M	M	M
LE0309	Service and Repair Hydraulic Systems and Components on Land-based Equipment (H/600/3440)	30	3	5	M	M	M(20)
LE0310	Service and Repair Pneumatic Systems and Components for Land-based Equipment (K/600/3441)	30	3	5	M	M	M
LE0311	Service and Repair Powershift, Hydrostatic and CVT Transmissions on Land-based Equipment (M/600/3442)	60	3	10	M	M	M
LE0314	Monitor the Handover and Installation of Land-based Equipment (T/600/3443)	30	3	5	M	M	M
LE0315	Inspect and Test Land-based Machinery and Equipment (A/600/3444)	60	3	10	M	M	M
LE0317	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace (L/601/4271)	60	3	10	M	M	M
LE0318	Undertaking Land-based Workshop Practice (M/600/9631)	60	3	10	M	CDA	M
LE0319	Understanding and Servicing Land-based Harvesting Machinery Processing (D/601/4260)	60	3	10	M	M	NA



Unit Ref:	Unit Title and ID Number	GLH	Unit Level	Credit Value	Assessment		
					P	W	T
Group A: Optional Units (30 credits) continued							
LE0320	Working with Land-based Diesel Fuel Injection Systems (D/601/4288)	60	3	10	M	M	M
LE0321	Familiarisation and Management of Land-based Vehicles (F/601/4252)	60	3	10	M	M	NA
LE0322	Working with Land-based Machinery Application Equipment (H/601/4289)	60	3	10	M	M	NA
LE0323	Understanding and Working with Land-based Vehicle Engine Technology (J/601/4267)	60	3	10	M	M	NA
LE0324	Understanding Computer Application and Control in Land-based Technology (J/601/4270)	60	3	10	M	M	M
LE0325	Undertaking Land-based Technology Engineering Drawing (J/601/4284)	60	3	10	M	M	NA
LE0326	Understanding and Servicing Land-based Harvesting Machinery cutting and lifting (K/601/4259)	10	3	10	M	M	NA
LE0327	Understanding and Servicing Land-based Machines Cultivation and Planting Equipment (K/601/4262)	60	3	10	M	CDA	NA
LE0328	Operate and Service Land-based Vehicle Transmission Systems (L/601/4254)	60	3	10	M	M	NA
LE0329	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment (L/601/4285)	60	3	10	M	CDA	NA
LE0330	Understanding and Servicing Mechanical Power Transmission Systems (M/601/4263)	60	3	10	M	M	M
LE0331	Understanding Land-based Vehicle Chassis Systems (M/601/4280)	60	3	10	M	M	M
LE0333	Understanding and Working with Groundcare Equipment (T/601/4264)	60	3	10	M	CDA	M
LE0334	Undertaking 4WD Vehicle Maintenance, Operation and Recovery (T/601/4281)	60	3	10	M	CDA	NA
LE0335	Understand and Work with Land-based Repair Processes and Materials Technology (Y/601/4256)	60	3	10	M	M	M
LE0336	Understanding Land-based Machinery Management (Y/601/4273)	60	3	10	NA	CDA	NA
LE0337	Working with Land-based Tool Hire Machinery and Mechanisms (Y/601/4290)	60	3	10	M	CDA	NA
LE0338	Working with Land-based Construction Plant Materials Handling Equipment (Y/601/4287)	60	3	10	M	CDA	NA
LE0343	Undertaking Land-based Machinery Operations (H/600/9805)	60	3	10	M	M	NA



UNIT LEO206 - PERFORM THERMAL JOINING AND CUTTING PROCESSES

Level: 2	Credit Value: 10	GLH: 60
Mapping: This unit is mapped to the LANTRA NOS 029NLE09		
Rationale: The aim of this unit is to provide the learner with the knowledge and skills required for carrying out thermal joining and cutting processes within land-based operations		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform thermal joining and cutting	1.1 Identify welding and thermal joining equipment 1.2. Identify ferrous and non-ferrous materials and their suitability 1.3 Prepare workplace, materials and equipment to carry out a thermal joining process 1.4 Use the correct techniques to carry out thermal joining tasks 1.5 Join ferrous or non-ferrous materials to the required quality and dimensions 1.6 Identify faults in welded, bronze welded and soldered joints. 1.7 Inspect and maintain equipment and change consumables used in joining processes 1.8. Safely set up and shut down equipment for oxy-acetylene gas heating, cutting and joining
2. Know how to perform thermal joining and cutting techniques	2.1 Describe how to identify ferrous and non ferrous materials and their respective joining characteristics 2.2. Describe material preparation and joining procedures 2.3 Describe the techniques for joining ferrous and non-ferrous materials using gas and electric welding and soldering methods 2.4 Describe how to select, prepare and set the relevant equipment to carry out welding and joining tasks 2.5 Describe how to detect and correctly identify faults and their causes in welded joints 2.6 Describe the precautions required when engaging in a thermal joining and cutting process 2.7 Describe how to safely set up equipment and use the correct techniques for oxy-acetylene gas heating, cutting and joining

Content

- a. How to identify ferrous and non ferrous materials and their respective joining characteristics materials to include:
 - i. low carbon steels
 - ii. medium carbon steels
 - iii. high carbon steels
 - iv. cast iron
 - v. aluminium
 - vi. stainless steel
 - vii. copper
 - viii. tin
 - ix. high strength steels
 - x. ultra high strength steels
- b. Material preparation and joining procedures required when carrying out butt, lap and fillet welds
 - i. tacking (size and spacing in relation to material thickness)
 - ii. positioning
 - iii. clamping
 - iv. jigs and fixtures
- c. The techniques for joining ferrous and non-ferrous materials using gas and electric welding and soldering methods including:
 - i. control of distortion
 - ii. weld and heat effects
 - iii. the properties and purpose of flux
- d. How to select, prepare and set the relevant equipment to carry out welding and joining tasks including:
 - i. setting pressures
 - ii. amperage
 - iii. voltages
 - iv. selecting electrode sizes
 - v. nozzle sizes
 - vi. wire speed
 - vii. selection of fluxes for bronze welding and soldering
 - viii. the removal of slag and flux deposits
- e. How to detect and correctly identify faults and their causes in welded joints
 - i. visual inspection
 - ii. non destruction and destruction
 - iii. undercutting,
 - iv. slag traps,
 - v. penetration,
 - vi. cracking
 - vii. incorrect preparation
 - viii. settings
 - ix. oxidation and carbonisation
 - x. spatter
 - xi. porosity
- f. The precautions required when engaging in a thermal joining and cutting process including:
 - i. fumes
 - ii. explosions
 - iii. fire
 - iv. sharp edges
 - v. airborne debris
 - vi. personal injury
- g. How to safely set up equipment and use the correct techniques for oxy-acetylene gas heating, cutting and joining
 - i. clean gas nozzles and soldering equipment
 - ii. identification of gas cylinders and equipment
 - iii. methods of assembly
 - iv. change gas cylinders and welding wire spools



Evidence Requirements

1. You must produce evidence of carrying out 2 of the 3 welded joints listed below using either gas or electric welding equipment
Butt joint
Lap joint
Fillet joint
2. You must produce evidence of carrying out thermal cutting on at least 1 occasion.

Evidence from simulated activities is acceptable for this unit.



UNIT LEO306 - LAND-BASED ENGINEERING OPERATIONS -SERVICE AND REPAIR ENGINES AND COMPONENTS

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is mapped to the LANTRA NOS 029NLE011		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to perform service and repair procedures on engines within land based engineering.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform service and repair procedures on engines and their components	1.1 Prepare, inspect and record the condition of engines and their components. 1.2 Use correct measuring equipment to verify compliance of engine components 1.3 Investigate failed or worn parts and record and report findings.
2. Be able to identify engine faults	2.1 Carry out tests to determine the cause of different engine problems 2.2 Set and adjust engine performance within specified limits. 2.3. Identify and rectify engine system faults
3. Understand how to analyse and interpret findings from engine inspections and rectify	3.1 Describe how to identify and rectify the cause of engine problems 3.2 Explain the methods of sealing combustion chambers, fuel and ignition systems. 3.3 Describe the effects of moisture and contaminates in fuel and ignition systems 3.4 Explain the procedure to verify correct engine timing covering both static and dynamic timing
4. Understand how to take engine measurements.	4.1 Describe the methods and techniques of taking engine specific measurements

Content

- a. Causes of engine problems including:
 - i. poor engine performance
 - ii. misfire
 - iii. backfire
 - iv. engine oil pressure
 - v. overheating
 - vi. seizure
 - vii. abnormal noise
 - viii. non starting
 - ix. excessive crank case breathing
 - x. oil consumption
 - xi. fuel delivery and system pressures
 - xii. air intake charge pressures
 - xiii. abnormal fuel usage
 - xiv. camshaft and ignition timing
 - xv. emissions including blue, white or black smoke
 - xvi. weak and rich fuel mixtures
 - xvii. restricted intake and exhaust air flow
 - xviii. verifying governor operation
 - xix. operation of cold starts
- b. Tests to determine the cause of different engine problems:
 - i. compression
 - ii. engine power
 - iii. fuel consumption
 - iv. fuel pressure
- c. Methods of sealing combustion chambers, fuel and ignition systems:
 - i. head gasket
 - ii. valves
 - iii. valve stem seal
 - iv. valve seats
 - v. piston rings
 - vi. fuel pipes
 - vii. sealed fuel tanks
 - viii. breathers
 - ix. sealed ignition systems
- d. Effects of moisture and contaminates in fuel and ignition systems
- e. Verifying correct engine timing covering both static and dynamic timing
- f. Methods and techniques of taking engine specific measurements:
 - i. piston and connecting rod
 - ii. piston ring gapping
 - iii. cylinder/liner taper, ovality and protrusion
 - iv. crankshaft journal ovality and end float
 - v. piston / head clearances
 - vi. valve, guide, seat, train, operating system
 - vii. cylinder head / block distortion
 - viii. engine oil pump

Evidence Requirements

1. **You must** produce evidence of inspecting, measuring, recording and reporting on the condition of **either** the **engine block or cylinder head**. (This does not require the stripping and rebuilding of components)
2. **You must** produce evidence of identifying engine faults by carrying out various tests

Evidence from simulated activities is acceptable for this unit.

**UNIT LEO307 - SERVICE AND REPAIR SUSPENSION SYSTEMS ON LAND-BASED EQUIPMENT****Level: 3****Credit Value: 5****GLH: 30****Mapping:** This unit is mapped to the LANTRA NOS 029NLE021**Rationale:** The aim of this unit is to provide the learner with the knowledge, understanding and skills required to service and repair suspension systems and components on land based equipment

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform service and repair operations on suspension systems and their components.	1.1 Remove, dismantle repair and reinstate suspension systems and components to manufacturer's specifications 1.2. Diagnose faults in suspension assemblies and their components and recommend actions
2. Understand the construction, function and operation of suspension systems	2.1 Describe the types, construction and operating principles of suspension assemblies and their components 2.2 Describe how to remove, dismantle, repair and reinstate suspension assemblies and components 2.3 Describe how to diagnose faults in suspension assemblies and components and recommend actions

Content

- a. Types, construction and operating principles of suspension assemblies and their components:
 - Assemblies**
 - i. cab suspension
 - ii. seat suspension
 - iii. axle suspension
 - Components**
 - i. cab mounts
 - ii. dampers
 - iii. springs
 - iv. accumulators
 - v. levelling devices
 - vi. cab and seat
- b. Types of suspension
 - i. non independent suspension
 - ii. independent suspension
 - iii. air suspension
 - iv. steel suspension
- c. Operation of suspension systems and components:
 - i. leaf and coil springs
 - ii. torsion bar
 - iii. air springs
 - iv. dampers
 - v. trailing arms
 - vi. ball joints
 - vii. bump stops
 - viii. anti-roll bars
 - ix. stabiliser bars
 - x. swinging arms
- d. Remove, dismantle, repair and reinstate suspension assemblies and components:
 - i. the preparation, testing and use of tools and equipment used for dismantling removing and replacing components.
 - ii. appropriate safety precautions
 - iii. the importance of logical and systematic processes.
 - iv. the inspection and testing of systems and components
 - v. the preparation of replacement units for re-fitting or replacement
 - vi. the reasons why replacement components and units must meet the original specifications (OES)
- e. Faults in suspension assemblies and components and recommend actions:
 - i. ride height (unequal and low)
 - ii. wear
 - iii. noises under operation
 - iv. fluid leakage
 - v. excessive travel
 - vi. bounce
 - vii. poor vehicle handling
 - viii. worn dampers
 - ix. worn joints
 - x. damaged linkages

Evidence Requirements

- 1. **You must** produce evidence of carrying out diagnosis and rectification activities on a suspension system **on two separate occasions. You must** use a **2 or more** step diagnostic activity.

Evidence from simulated activities is **not** acceptable for this unit.



UNIT LEO308 - MAINTAIN ELECTRONIC CONTROL AND MONITORING SYSTEMS ON LAND-BASED EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is mapped to the LANTRA NOS 029NLE023		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to maintain electronic control and monitoring systems on land based equipment.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to maintain electronic control and monitoring systems	1.1 Identify and locate electronic control and monitoring systems and their components to retrieve and interpret stored information 1.2 Establish parameters, calibrate and verify performance of the electronic control and monitoring systems 1.3 Maintain electronic control and monitoring systems and their components to confirm integrity 1.4 Prepare the system to be tested and carry out a diagnostic test using diagnostic tools and equipment to evaluate or rectify system performance
2. Understand how to maintain electronic control and monitoring systems	2.1 Summarise electronic control and monitoring systems and their application 2.2 Summarise how control and monitoring signals are generated and communicated, and the causes and effects of interference 2.3 Summarise the function of electronic components 2.4 Describe the tools and equipment used to test, repair and reinstate electronic control and monitoring systems and their components 2.5 Describe the methods used to check and maintain system integrity 2.6 Summarise how to retrieve, interpret, reinstate and verify information stored in electronic control units (ECU)

Content:

- a. Electronic control and monitoring systems and their application:
 - i. engine management
 - ii. transmission management
 - iii. headland management
 - iv. performance monitoring
 - v. closed circuit television monitoring
 - vi. equipment instrumentation
 - vii. driver information
 - viii. suspension control
 - ix. hydraulic control
 - x. pilot steering
 - xi. global positioning service
 - xii. multiplexing
 - xiii. telemetry automatic guidance systems
- b. Control and monitoring signals and the causes and effects of interference:
 - i. CAN bus
 - ii. ISO bus
 - iii. GPS/satellite
 - iv. wireless
 - v. pulse width modulation PWM
- c. Types and methods of inhibiting external electronic influences:
 - i. screening
 - ii. twisted pairs
 - iii. grounding/earthing
 - iv. connections
 - v. wiring routes/fixings
- d. Function of electronic components including:
 - i. transistors
 - ii. capacitors
 - iii. diodes
 - iv. regulators
 - v. resistors
 - vi. transformers
 - vii. thermistors
 - viii. transducers
 - ix. transmitters
 - x. actuators
 - xi. electronic control units (ECU)
- e. Tools and equipment used to test, repair and reinstate electronic control and monitoring systems and their components:
 - i. multi meters – digital and analogue
 - ii. voltmeters
 - iii. ammeters
 - iv. ohmmeter
 - v. oscilloscopes
 - vi. internal and external electronic interrogation equipment
 - vii. manufactures dedicated equipment
- f. Methods used to check and maintain system integrity:
 - i. understand the threats of electronic system integrity for example connections, routing of wiring and fixings, grounding and earthing
- g. Retrieve, interpret, reinstate and verify information stored in electronic control units (ECU)



Evidence Requirements

1. You must produce evidence of carrying out diagnosis and rectification activities from 2 different monitoring systems out of the 5 listed below* . The fault should involve a 2 or more step diagnostic activity.
Engine Management Systems
Chassis Management System
Information Management System
Performance Management System
Headland Management System

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of faults occurring in all the types of electrical systems, e.g. through professional discussions.

Evidence from simulated activities is **not** acceptable for this unit.



UNIT LEO309 - SERVICE AND REPAIR HYDRAULIC SYSTEMS AND COMPONENTS ON LAND-BASED EQUIPMENT

Level: 3	Credit Value: 5	GLH: 30
Mapping: This unit is mapped to the LANTRA NOS 029NLE024		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to repair and service hydraulic systems in land based equipment.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform service and maintenance operations on hydraulic systems and their components	1.1 Inspect performance of hydraulic systems and components 1.2 Prepare the system to be tested and carry out tests using diagnostic tools to assess system performance 1.3 Interpret diagnostic results and recommend actions 1.4 Remove, dismantle, repair and reinstate system and components to manufacturer's specifications
2. Understand the construction, function and operation of hydraulic circuit systems and their components used in land based engineering applications.	2.1 Interpret circuit diagrams and symbols and their functions within the system 2.2 Explain how to dismantle, repair and reinstate hydraulic components and systems 2.3 Explain the application of valves and the function of hydraulic systems and components 2.4 Identify diagnostic test/s that will evaluate hydraulic system performance 2.5 Interpret and compare test results

Content

a. Circuit diagrams and symbols and their functions within the system including:

Circuit types

- i. open centre
- ii. closed centre
- iii. load sensing
- iv. hydrostatic

Components

- i. hydraulic pumps and motors fixed and variable displacement
- ii. hydraulic pressure maintaining valves, relief valves, shock valves
- iii. hydraulic control valves, distributors, solenoid valves, proportional valves, pressure differential valves, pilot operated valves, trailer brake valve
- iv. hydraulic rams, single, acting, double acting and cushioned
- v. hydraulic direction flow valves, flow dividers, orbital valves, priority valves, restrictors
- vi. reservoirs
- vii. accumulators

b. Dismantle, repair and reinstate hydraulic components and systems:

- i. the preparation, testing and use of tools and equipment used for dismantling removing and replacing components.
- ii. appropriate safety precautions
- iii. the importance of logical and systematic processes.
- iv. the inspection and testing of systems and components
- v. the preparation of replacement units for re-fitting or replacement
- vi. the reasons why replacement components and units must meet the original specifications (OES)

c. Application of valves and the function of hydraulic systems and components:

Valves

- i. orbital valves
- ii. proportional valves
- iii. load sensed circuits
- iv. hydrostatic circuits
- v. trailer brake valves

Hydraulic systems and components

- i. hydraulic pumps and motors fixed and variable displacement
- ii. hydraulic pressure maintaining valves, relief valves, shock valves
- iii. hydraulic control valves, distributors, solenoid valves, proportional valves, pressure differential valves, pilot operated valves, trailer brake valve
- iv. hydraulic rams, single, acting, double acting and cushioned
- v. hydraulic direction flow valves, flow dividers, orbital valves, priority valves, restrictors
- vi. reservoirs
- vii. accumulators

d. Diagnostic test/s that will evaluate hydraulic system performance:

- i. flow rate
- ii. temperature
- iii. pressure

e. Compare test results

- i. justify to manufacturers specifications and summarise options and recommendations

Evidence Requirements

- 1. **You must** produce evidence of carrying out diagnosis and rectification activities on a hydraulic system **on two separate occasions**. **You must** use a **2 or more** step diagnostic activity.

Evidence from simulated activities is **not** acceptable for this unit.



UNIT LEO310 - SERVICE AND REPAIR PNEUMATIC SYSTEMS AND COMPONENTS FOR LAND-BASED EQUIPMENT

Level: 3	Credit Value: 5	GLH: 30
Mapping: This unit is mapped to the LANTRA NOS 029NLE025		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to service and repair pneumatic systems and components for land based equipment.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1 Be able to perform service and repair operations on pneumatic systems and components.	1.1 Inspect performance of pneumatic systems and components 1.2 Prepare system to be tested and carry out tests using diagnostic tools 1.3 Interpret and record the results and recommend actions 1.4 Remove, dismantle, repair and reinstate system and components to manufacturers' specification
2. Understand the construction, function and operation of pneumatic systems and components used in land-based engineering	2.1 Interpret circuit diagrams and symbols and their functions within a pneumatic system 2.2 Explain the application and function of pneumatic systems and components 2.3 Explain diagnostic tests and how to interpret the results 2.4 Describe how to dismantle, repair and reinstate pneumatic systems and components

Content;

a. Interpret circuit diagrams and symbols and their functions within a pneumatic system:

Pneumatic systems

- i. air brakes
- ii. air suspension
- iii. compressed air systems

Component symbols for

- i. air compressors, air pressure regulating valves
- ii. relief valves
- iii. dump valves
- iv. air pressure control valves
- v. hand brake valves
- vi. foot brake valves
- vii. diaphragm operated valves
- viii. air activated cylinders,
- ix. air cushions
- x. fail-safe/ emergency system components,
- xi. air receivers and dryers

b. Application and function of pneumatic systems and components:

- i. air compressors, air pressure regulating valves
- ii. relief valves
- iii. dump valves
- iv. air pressure control valves
- v. hand brake valves
- vi. foot brake valves
- vii. diaphragm operated valves
- viii. air activated cylinders
- ix. air cushions
- x. fail-safe/ emergency system components
- xi. air receivers and dryers

c. Diagnostic tests and how to interpret the results:

- i. summarise the options and recommendations that are formulated from the test results

d. Dismantle, repair and reinstate pneumatic systems and components:

- i. the preparation, testing and use of tools and equipment used for dismantling removing and replacing components.
- ii. appropriate safety precautions
- iii. the importance of logical and systematic processes.
- iv. the inspection and testing of systems and components
- v. the preparation of replacement units for re-fitting or replacement
- vi. the reasons why replacement components and units must meet the original specifications (OES)

Evidence Requirements

- 1. **You must** produce evidence of carrying out diagnosis and rectification activities on a pneumatic system **on two separate occasions. You must** use a **2 or more** step diagnostic activity.

Evidence from simulated activities is **not** acceptable for this unit.



UNIT LEO311 - SERVICE AND REPAIR POWERSHIFT, HYDROSTATIC AND CVT TRANSMISSIONS ON LAND-BASED EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is mapped to the LANTRA NOS 029NLE026		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to carry out service and repair on powershift, hydrostatic, CVT transmissions on land based equipment.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform service and repair operations on powershift, hydrostatic and CVT transmissions and their components	1.1 Identify transmissions and their components 1.2 Remove, dismantle, repair and reinstate transmission to manufacturer’s specification and standards 1.3 Perform operational and diagnostic test identifying and categorising faults in transmission
2. Understand the construction function and operation of powershift, hydrostatic, CVT transmissions and their components	2.1 Interpret technical documentation relating to transmissions to perform diagnostic tests 2.2 Explain the different types of transmissions including layout, construction, operating principles and function 2.3 Describe how to remove, dismantle, repair and reinstate powershift, hydrostatic, CVT transmissions and their components 2.4 Evaluate faults in powershift, hydrostatic and CVT transmissions using operational and diagnostic test data

Content:

- a. Interpret technical documentation relating to transmissions to perform diagnostic tests including:
 - i. drive paths
 - ii. shift and engagement patterns
 - iii. stationary and rotating components
 - iv. fault codes
 - v. monitoring intermittent faults
 - vi. simulation
 - vii. substitution
 - viii. operational tests
- b. Different types of transmissions including layout, construction, operating principles and function including:
 - i. speed sequencing and / or matching components
 - ii. directional change and / or shuttle components
 - iii. range change and variable speed components
 - iv. speed monitoring devices
 - v. transmission clutching and braking components
 - vi. single and multiple epicyclic units
 - vii. variable displacement pumps
 - viii. hydrostatic motors
 - ix. safety and protection devices
 - x. operational limitations - stationary work, towing, bump starting, engine braking
- c. Remove, dismantle, repair and reinstate powershift, hydrostatic, CVT transmissions and their components:
 - i. the preparation, testing and use of tools and equipment used for dismantling removing and replacing components.
 - ii. appropriate safety precautions
 - iii. the importance of logical and systematic processes.
 - iv. the inspection and testing of systems and components
 - v. the preparation of replacement units for re-fitting or replacement
 - vi. the reasons why replacement components and units must meet the original specifications (OES)
- d. Evaluate faults in powershift, hydrostatic and CVT transmissions using operational and diagnostic test data:
 - i. mechanical
 - ii. hydraulic
 - iii. electrical / electronic
 - iv. operator use
 - v. regular and irregular noise
 - vi. lock up
 - vii. loss of drive
 - viii. drag
 - ix. overheating
 - x. vibration
 - xi. jump out
 - xii. non selection
 - xiii. intermittent
 - xiv. continuous
 - xv. record faults and recommend appropriate action



Evidence Requirements

1. You must produce evidence of carrying out diagnosis and rectification activities on all the different transmission systems listed below . The faults should involve a 2 or more step diagnostic activity.
Powershift
Hydrostatic
CVT

Simulated activity **will be** acceptable in diagnosis and rectification on no more than **1** occasion.

**UNIT LE0314 - MONITOR THE HANDOVER AND INSTALLATION OF LAND-BASED EQUIPMENT**

Level: 3	Credit Value: 5	GLH: 30
Mapping: This unit is mapped to the LANTRA NOS 029NLE029		
Rationale: The aim of this unit is to provide the learner with the knowledge, understanding and skills required to prepare for and handover the installation of land-based equipment.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to perform the handover and installation of land-based equipment	1.1 Identify a suitable location, agree and prepare for handover and installation with customer 1.2 Use the correct procedure to handover and install the equipment as specified 1.3. Use an appropriate format to record the results of the installation
2. Understand how to perform the handover and installation of land-based	2.1 Identify the reasons and benefits of handover and installation of products 2.2 Describe how to carry out an installation using a systematic process and the relevant quality control systems including special machine characteristics 2.3 Describe technical advice and assistance within limits of own authority and how to deal with queries and problems

Content

- a. Reasons and benefits of handover and installation of products including:
 - i. legal
 - ii. safety
 - iii. machine economic
 - iv. performance
 - v. efficiency
 - vi. reliability
 - vii. professionalism
 - viii. customer care
 - ix. customer perceptions of after sales service
- b. Installation using a systematic process and the relevant quality control systems including special machine characteristics including:
 - i. introduction to the equipment
 - ii. legal requirements
 - iii. operation and control techniques
 - iv. safe operating practice
 - v. limitations of use
 - vi. explanation of operators handbook
 - vii. operating settings
 - viii. performance and efficiency
 - ix. demonstration
 - x. service and maintenance requirements
 - xi. warranty terms and conditions
 - xii. establish the operators competence and understanding
 - xiii. use of supporting materials
 - xiv. documentation
 - xv. recording and quality control systems required
 - xvi. signing of documentation
 - xvii. effective communication skills
 - xviii. professional standards (courtesy, dress, language)
- c. Technical advice and assistance within limits of own authority and how to deal with queries and problems:
 - i. procedures for dealing with queries and unexpected problems
 - ii. the extent of personal authority and responsibility (for example technical, financial, warranty, handling complaints)
 - iii. the implications of giving information and advice beyond authorized limits (for example personal and corporate liability)
 - iv. procedures when issues are outside own authority, for example referral to supervisor

Evidence Requirements

- 1. **You must** produce evidence of carrying out the handing over and installation of land-based equipment **on two separate occasions.**

Evidence from simulated activities is **not** acceptable for this unit.

**UNIT LEO315 - INSPECT AND TEST LAND-BASED MACHINERY AND EQUIPMENT****Level: 3****Credit Value: 10****GLH: 60****Mapping:** This unit is mapped to the LANTRA NOS 029NLE030**Rationale:** The aim of this unit is to provide the learner with the knowledge, understanding and skills required to inspect and test land-based machinery and equipment.

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to inspect and test land-based machinery and equipment	1.1. Establish the objectives of the inspection or test 1.2. Observe and record information to evaluate the condition, application and performance of equipment 1.3. Prepare and carry out test(s)
2. Be able to analyse and interpret findings	2.1. Check the data gathered is accurate and takes account of test conditions 2.2. Recognise the cause and effect of failure/s 2.3. Analyse the data using approved methods and procedures 2.4. Present findings and recommendations
3. Understand how to inspect and test land-based machinery and equipment	3.1. Describe methods used to investigate intermittent faults 3.2. Describe the causes and symptoms of malfunctions 3.3. Describe the methods, diagnostic and specialist equipment used to establish conformity with manufacturer's, technical and legislation requirements 3.4. Describe the difference between a characteristic and a malfunction
4. Understand how to formulate and recommend actions	4.1. Describe actions that could be considered following inspection and testing and their implications 4.2. Explain how to recognise the need for operator training requirements to avoid reoccurrence of failures

Content

- a. Methods used to investigate intermittent faults:
 - i. the methods and techniques used to investigate, diagnose and record intermittent faults
- b. Causes and symptoms of malfunctions:
 - i. differentiate between the cause and effect of a failure
 - ii. establish the reasons for failure and the symptoms that they produce
- c. Methods, diagnostic and specialist equipment used to establish conformity with manufacturer's, technical and legislation requirements:
 - i. logical elimination
 - ii. sensory
 - iii. operational
 - iv. simulation
 - v. comparison
 - vi. isolation of components
 - vii. comparing results against manufacturers specification
- d. The difference between a characteristic and a malfunction
- e. Actions that could be considered following inspection and testing and their implications:

Actions

- i. replace
- ii. repair
- iii. modify
- iv. update
- v. substitution
- vi. impound
- vii. beyond economic repair
- viii. service
- ix. pass / fail
- x. unsafe

Implications

- i. warranty
 - ii. cost effectiveness
 - iii. integrity of repair
 - iv. insurance considerations
 - v. timescale
 - vi. health and safety
 - vii. impact on dealership operations
 - viii. impact on the customers' operations
- f. The need for operator training requirements to avoid reoccurrence of failures:
 - i. forced breakage
 - ii. lack of maintenance
 - iii. unauthorised intervention
 - iv. sabotage/ vandalism
 - v. overload
 - vi. operator abuse
 - vii. inappropriate usage

Evidence Requirements

- 1. **You must** produce evidence of carrying out **at least 3** different inspections and testing of land-based machinery and equipment

Evidence from simulated activities is **not** acceptable for this unit.

Evidence for this unit can come from Units 306 & 309.



UNIT LEO317 - UNDERSTANDING HEALTH, SAFETY AND WELFARE IN THE LAND-BASED ENGINEERING WORKPLACE

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS		
Rationale: This unit aims to introduce learners to safe working skills and understanding 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.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the foundations of health and safety in the workplace	1.1. Explain legal health and safety responsibilities of an employer and employee 1.2. Explain how legislation affects the safe working practices and procedures for employee and employer in the workplace 1.3. Examine implications to the individual, business and national economy of accidents in the workplace
2. Understand the organisational requirements within the workplace	2.1. Explain the framework of health and safety management within a selected land based engineering business 2.2. Explain how a selected land based engineering business promotes and implements health and safety policies and practices
3. Be able to assess safe working environment, policies and procedures in the workplace	3.1. Identify potential hazards and risks to the health in a selected land-based engineering situation 3.2. Assess risks for given land-based engineering operations 3.3. Report on the procedures for reporting injuries, diseases and dangerous occurrences within a selected land-based engineering business
4. Understand how to minimise hazards and risks in the workplace	4.1. Justify PPE and safety equipment to be used when undertaking selected land based engineering operations 4.2. Explain how selected regulations affect the working practices in the workplace

Content:

Foundations of health and safety in the workplace.

- a. Definitions
 - i. health
 - ii. safety
 - iii. welfare
 - iv. occupational and work-related ill health
 - v. environmental protection
 - vi. accident
 - vii. near miss
 - viii. dangerous occurrence
 - ix. major injury
 - x. three-day injury
 - xi. hazard; risk; incident
 - xii. direct and indirect costs.
- b. Employer's responsibilities
 - i. health
 - ii. safety and welfare
 - iii. safe systems of work
 - iv. risk assessments
 - v. instruction
 - vi. training and supervision
 - vii. competent employees
 - viii. written health and safety policy
- c. Employee's responsibilities
 - i. responsibility for themselves
 - ii. responsibility for others
 - iii. co-operation
 - iv. communication
 - v. reporting defects
 - vi. no interfering with health and safety equipment.
- d. Legal framework and Legislation
 - i. common law
 - ii. statute law
 - iii. criminal law
 - iv. civil law
 - v. duties of care
 - vi. statutory liability (absolute, practicable and reasonably practicable)
 - vii. the role of the HSE and inspectors
- e. Relevant, current legislation
- f. Health and Safety at Work etc Act 1974
- g. Control of Substances Hazardous to Health Regulations (2002) (COSHH)
- h. Reporting Injuries
- i. Diseases and Dangerous Occurrence Regulations (RIDDOR)
- j. Provision and Use of Work Equipment Regulations (PUWER)
- k. Lifting Operations and Lifting Equipment Regulations (LOLER)
- l. Noise at Work regulations 1989
- m. Workplace health, safety and Welfare (Health, Safety and Welfare)
- n. Regulations 1992
- o. Grinding wheel regulations.

Content:

- a. Implications of workplace accidents
- b. Individual
 - i. pain
 - ii. suffering and grief
 - iii. loss of wages
 - iv. family
 - v. social life
 - vi. loss of ability to work
 - vii. long-term disability/illness.
- c. Business
 - i. loss of business
 - ii. damage to reputation
 - iii. loss of income
 - iv. sickness payments
 - v. insurance cost
 - vi. prosecution/civil costs
 - vii. damage to machinery
 - viii. machinery out of action.
- d. National / Economic
 - i. stricter control procedures/guidelines
 - ii. higher insurance costs.

Organisational requirements within the workplace

- a. Health and Safety Management
 - i. chain of responsibility (employee, supervisor, managing director)
 - ii. employee responsibility
 - iii. employer's responsibility
 - iv. risk assessments
 - v. safety audits
 - vi. lines of communication
 - vii. organisational responsibilities (employers, employees, health and safety and other advisers)
 - viii. competent person; contractor responsibilities
- b. Legal responsibilities between:
 - i. premises owner/controller
 - ii. user
 - iii. hirer and duties of suppliers
 - iv. manufacturers and designers of articles and substances for use at work.
- c. Promotion
 - i. posters
 - ii. leaflets
 - iii. monthly accident figures
 - iv. the relationship between health and safety culture and health and safety performance e.g. human factors and their influence on health and safety performance,
 - v. attitude
 - vi. motivation
 - vii. perception
 - viii. competence
 - ix. violation
 - x. health and safety training e.g. induction, job specific, specialist.

Content:

Implementation

- i. training
- ii. tool box talks
- iii. risk assessments
- iv. safety audits
- v. monitoring
- vi. health and safety risks arising from work activities
- vii. consultation with employees
- viii. safe plant and equipment
- ix. safe handling and use of substances
- x. information, instruction and supervision
- xi. competency for tasks and training, accidents
- xii. first aid and work related ill health policy monitoring.

Health and Safety Policies and Practices

- i. company health and safety statement
- ii. training
- iii. accident reporting
- iv. hazard reduction
- v. major incident procedure
- vi. use of flammable liquids and gases
- vii. employees responsibilities
- viii. manual handling.

Assess safe working environment, policies and procedures in the workplace

- a. Legislation
- b. Health and Safety at Work Act 1974,
- c. Management of Health and Safety at Work Regulations 1999
- d. Health and Safety (Consultation with Employees) Regulations 1996
- e. Health and Safety (First Aid) Regulations 1981, Reporting of Injuries
- f. Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)
- g. Pressure Systems Safety Regulations 2000
- h. Workplace (Health, Safety and Welfare) Regulations 1992
- i. Provisions and Use of Work Equipment Regulations 1998
- j. Lifting Operations and Lifting Equipment Regulations 1998
- k. Supply of Machinery (Safety) Regulations 1992 as amended 1994
- l. Control of Noise at Work Regulations 2005
- m. Health and Safety (Display Screen Equipment) Regulations 1992
- n. Work at Height Regulations 2005
- o. Environment Act 1995
- p. Control of Substances Hazardous to Health Regulations 2002 (COSHH)
- q. Personal protective equipment (PPE)

Potential hazards and risks

- a. Fatal
- b. Non-fatal accidents
- c. Occupational asthma
- d. Dermatitis
- e. Zoonoses
- f. Noise
- g. Muscular skeletal disorders
- h. Slips, trips and falls
- i. Contact with machinery
- j. Struck by moving object
- k. Contact with electricity, machinery collapsing /overturning
- l. Use of flammable liquids and gases

Content:

Assess risks

- a. Legal aspects
- b. Types of risk assessment (quantitative, qualitative, generic)
- c. Accident categories
- d. Specific to task
- e. Hazards
- f. Who's at risk
- g. Special cases eg young persons
- h. Lone workers
- i. Control measures
- j. Legal requirements
- k. Recording, review and monitoring.

Procedures

- a. COSHH
- b. Hierarchy of risk control
- c. Report Injuries
- d. RIDDOR
- e. Use of accident book
- f. Mishap forms,
- g. Near-miss reports.

Minimise hazards and risks in the workplace

Risk and hazards reduction

- a. Principles of accident prevention
- b. Hierarchy of risk control
- c. Identifying and managing health risks
- d. Safe systems of work
- e. Lone workers
- f. Permits to work
- g. Emergency procedures (fire, first aid).

PPE

- a. Gloves (latex, welding, rigger)
- b. Goggles
- c. Steel toe capped boots
- d. Coverall
- e. Dust mask
- f. Ear defenders
- g. Helmet
- h. Welding mask
- i. Barrier substances.

Safety Equipment

- a. Machine guards
- b. Welding curtains
- c. Gas regulators
- d. Emergency stop buttons
- e. Gas extraction units
- f. First aid kit
- g. Fire extinguisher
- h. Axle stands
- i. Wheel chocks
- j. Power transformers
- k. Manual handling aids.



Evidence Requirements

1. **You must** produce evidence of identifying potential hazards/risks in the workplace and carry out risk assessments on the hazard/risk identified **on 2 separate occasions.**

Evidence from simulated activities is acceptable for this unit.



UNIT LE0318 - UNDERTAKING LAND-BASED WORKSHOP PRACTICE

Level: 3

Credit Value: 10

GLH: 60

Mapping: This unit is linked to the Land-based Service Engineering NOS CU28

Rationale: This unit aims to provide learners with an understanding of the principles of land-based workshop practice and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Know the importance of health and safety and safe working practices within a workshop environment	1.1. Identify potential hazards in a land-based maintenance workshop 1.2. State the range of legislations and/or codes of practice that apply to given workshop operations 1.3. State reasons for the need to follow legislations and safe working practices in the workshop environment
2. Be able to use hand tools, joining and cutting equipment commonly in land-based maintenance workshops	2.1. Identify a range of hand tools and joining and cutting equipment used in land-based maintenance workshops and state their purpose. 2.2. Safely use a given range of hand tools and joining and cutting equipment 2.3. Demonstrate safe and correct maintenance procedures for a given range of hand tools and joining and cutting equipment
3. Understand selection and use of materials suitable for purpose	3.1. Identify a range of materials commonly used for the repair of land-based equipment 3.2. Justify the selection of material(s) to meet given repair objectives 3.3. Compare the use of selected materials for given repair situations
4. Be able to maintain, replace or repair worn or broken components in a land-based situation	4.1. Inspect a selected land based machine to identify the need for safe repair or replacement of identified worn or damaged components 4.2. Prepare tools and materials and safely repair or replace worn or damaged land-based equipment components to meet given specifications 4.3. Make recommendations for possible changes to repair and component replacement procedures carried out on a selected land-based machine

Content:

Health, Safety and Safe Working Practices within a Workshop Environment

(Land based maintenance workshop where several staff are operating. Workshop where routine and non routine maintenance, fabrication and joining may be carried out at the same time).

Potential hazards

- a. Fumes
- b. Sparks
- c. Combustion of materials
- d. Faulty equipment
- e. Blocked access/egress
- f. Lifting heavy components
- g. Unsafe working area
- h. Slipping
- i. Tripping
- j. Electric cables

Legislations

- a. Health and Safety at Work etc Act 1974
- b. Provision and Use of Work Equipment Regulations (PUWER) 1998
- c. Reporting of Injuries
- d. Diseases and Dangerous Occurrences Regulations (RIDDOR)1995,
- e. Control of Substances Hazardous to Health Regulations (COSHH) 1998
- f. Grinding Wheels Regulations

Codes of practice

- a. Personal Protective Equipment (PPE)
- b. Machine guarding
- c. Company health and safety policy
- d. First aid policy
- e. Reporting procedures
- f. Personal hygiene facilities
- g. Housekeeping policies
- h. Waste storage / disposal policy
- i. Fire exits and procedures.

Reasons for the need to follow legislation and codes of practice

- a. Personal health and safety
- b. Legal requirements
- c. Injury to bystanders
- d. Work efficiency
- e. Location of tools and equipment
- f. Accountability for work done.

Hand tools, Joining and Cutting Equipment commonly in Land-based Maintenance Workshops

Hand tools – selection, identification and safe use of common powered and non-powered hand tools;-

- a. Non-powered
 - i. hammers
 - ii. hacksaws
 - iii. files
 - iv. spanners
 - v. wrenches
 - vi. measuring devices
 - vii. screwdrivers
 - viii. scribes
 - ix. marking out tools
 - x. punches
 - xi. chisels
 - xii. shears
 - xiii. pullers

Content:

- b. Powered
 - i. drills
 - ii. grinders
 - iii. polishers
 - iv. cutters
 - v. drills
 - vi. tool storage
 - vii. tool transportation
 - viii. health and safety

Selection, identification and safe use of joining equipment

- a. Non-thermal
 - i. riveting
 - ii. adhesives
 - iii. threaded fasteners
- b. Thermal
 - i. manual metal arc
 - ii. metal inert gas
 - iii. metal active gas
 - iv. spot
 - v. oxy/acetylene
 - vi. soldering
 - vii. brazing.

Maintenance procedures

- a. Hand tool cleaning and storage
- b. Transportation
- c. Sharpening cutting tools
- d. Correct angles
- e. Replacement grinding / cutting discs
- f. Electrical equipment observation
- g. Electrical testing requirements.

Selection and Use of Materials suitable for purpose

- a. Metallic
 - i. iron
 - ii. steel
 - iii. copper
 - iv. brass
 - v. aluminium
 - vi. cast iron
 - vii. lead
 - viii. bronze
- b. Non- metallic
 - i. wood
 - ii. rubber
 - iii. plastics
 - iv. fibres
 - v. paper
 - vi. thermo-setting
 - vii. thermoplastic.

Justify the selection of material(s)

- a. Ease of use
- b. Cost
- c. Surface finish
- d. Self lubrication
- e. Weight
- f. Resistance to wear
- g. Oxidation resistance
- h. Conductivity
- i. Heat resistance

Content:

Compare materials

- a. Hardness
- b. Brittleness
- c. Ductility
- d. Workability
- e. Strength
- f. Cost
- g. Durability.

Maintain, Replace or Repair worn or broken components in a land-based situation

For example as a guide: tilling / cultivating / planting / sowing / spreading / cutting / harvesting / baling / loading / lifting / weighing machines, cattle crush.

Replacements

- a. Worn Components
- b. Damaged Components
- c. Bearings
- d. Bushes
- e. Seals

Repair situation

- a. Meeting job instructions
- b. Component specification
- c. Fitness for purpose (tools, equipment)
- d. Correct waste disposal
- e. Quality control
- f. Testing procedure
- g. Inspection
- h. Reporting unsolved repair jobs
- i. Broken welds
- j. Framework fractures
- k. Re-alignments
- l. Re-fabrications

Techniques

- a. Drilling
- b. Sawing
- c. Tightening
- d. Measuring
- e. Polishing
- f. Welding
- g. Joining
- h. Gluing
- i. Lubrication requirements e.g. grease, oil, 'anti rust' agents
- j. Service and maintenance schedules
- k. Manufacturers' handbooks
- l. Health and safety; cleaning materials
- m. Finish
- n. Efficiency
- o. Agreed timeframes

Content:

Changes to repair and component replacement procedures

- a. Strengthening of weak areas
- b. Heavier duty materials
- c. Gussets
- d. Braces
- e. Manufacturer updates/modifications to wearing components
- f. Improvement to lubrication
- g. Reduction of vibration
- h. Spreading load
- i. Recommendations for changes to procedure
 - i. to reduce time
 - ii. save costs
 - iii. improve working conditions
 - iv. improve longevity
 - v. improve effectiveness.

Evidence Requirements

<p>1. You must produce evidence of selecting, using and maintaining a range of tools, covering all of those listed below on at least 2 different occasions</p>
<ul style="list-style-type: none"> • Powered tools
<ul style="list-style-type: none"> • Non powered tools
<ul style="list-style-type: none"> • Joining equipment
<ul style="list-style-type: none"> • Cutting equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LEO319 - UNDERSTANDING AND SERVICING LAND-BASED HARVESTING MACHINERY PROCESSING

Level: 3	Credit Value: 10	GLH: 60
<p>Mapping: This unit is linked to the National Occupational Standard LE018 Service and Repair Land-based Harvesting and Processing Equipment</p>		
<p>Rationale: This unit aims to provide learners with an understanding of crop processing in land-based harvest machinery, the control of and specification of crop processing mechanisms in harvesting machinery and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training</p>		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the principles of crop processing in land based harvesting machinery	1.1. Explain the principles of crop processing in harvesting machinery 1.2. Explain how processing mechanisms accommodate varying crops and crop conditions
2. Be able to carry out 'preparation for work' procedures on crop processing mechanisms in harvesting machinery	2.1. Carry out adjustments to enable crop processing mechanisms to give optimal performance in a range of crops and crop conditions
3. Be able to carry out maintenance, repair and 'out of season lay up' procedures on crop processing mechanisms in harvesting machinery	3.1. Carry out maintenance procedures on crop processing mechanisms 3.2. Carry out procedures to identify and rectify faults on crop processing mechanisms 3.3. Carry out 'out of season lay up' procedures to crop processing mechanisms
4. Understand the 'control of' and specification of crop processing mechanisms in harvesting machinery	4.1. Explain the operator control procedures of crop processing mechanisms 4.2. Explain the specification data of crop processing mechanisms

Content:

- a. Harvesting machinery range
 - i. cereal,
 - ii. green crop harvesters
 - iii. balers
 - iv. root crop harvesters
 - v. grading equipment
 - vi. timber harvesters.
- b. Crops
 - i. cereals and other combinable crops
 - ii. root crops
 - iii. green and forage crops
 - iv. timber.
- c. Crop processing
 - i. threshing
 - ii. cleaning
 - iii. crimping
 - iv. separating
 - v. conveying
 - vi. tying
 - vii. wrapping.

Principles of Crop Processing in land-based Harvesting Machinery

- a. Processing mechanisms
 - i. threshing
 - ii. cleaning
 - iii. crimping
 - iv. separating
 - v. conveying
 - vi. tying and wrapping
 - vii. accommodation for crops and crop conditions
- b. Processing system principles
 - i. threshing (peg drum, rasp bar drum)
 - ii. stripping
 - iii. cutting
 - iv. separation (rotary drum, straw walker, tined rotor)
 - v. packing (ram, fixed chamber, variable chamber)
 - vi. packaging (twine wrap, net wrap, plastic wrap, knot formation)
- c. Cleaning system principles
 - i. sieve
 - ii. blower/fans
 - iii. vibrating
 - iv. reciprocating
 - v. rotary
 - vi. gravity
 - vii. brush
 - viii. cyclone
 - ix. roller table
 - x. contra-rotating roller
 - xi. duplex web
 - xii. fixed web
 - xiii. grading equipment
 - xiv. crop dryers.

Content:

'Preparation for Work' procedures on Crop Processing Mechanisms in Harvesting Machines

- a. Adjustments
 - i. forward speed
 - ii. drum speed
 - iii. clearances
 - iv. height
 - v. length
 - vi. density
 - vii. size
 - viii. levels
 - ix. alignment
 - x. speed
 - xi. material flow
 - xii. screen adjustment
 - xiii. air flow
 - xiv. bale size
 - xv. wrap setting
 - xvi. damage assessment
 - xvii. loss monitoring as required by machine manufacturer
 - xviii. crop conditions
 - xix. soil conditions
 - xx. weather conditions
- b. Optimal performance
 - i. maximising crop harvested
 - ii. crop quality and condition
 - iii. crop suitability for storage and further processes
 - iv. meeting customer requirements
 - v. minimising crop loss
 - vi. crop damage
 - vii. contamination (soil, weed seeds, foreign bodies)
- c. Workshop settings
 - i. manufacturers' manuals and data
 - ii. drive-line
 - iii. height
 - iv. speed
 - v. levels
 - vi. operation of controls
 - vii. timing of components
 - viii. alignment
 - ix. density
 - x. screen size
 - xi. air flow
 - xii. wrap requirements and settings
 - xiii. twine settings
- d. Health and Safety
 - i. risk assessment
 - ii. personal protective equipment (PPE)
 - iii. relevant current legislation
- e. Crop conditions
 - i. damp
 - ii. dry
 - iii. standing
 - iv. laid
 - v. sparse
 - vi. dense.

Content:

Maintenance, Repair and 'out of season lay up' procedures on Crop Processing Mechanisms in Harvesting Machinery

- a. Maintenance procedures - As specified in manufacturer's guidance
- b. Workshop Manuals
- c. Operator manuals
- d. Daily maintenance
- e. Short term maintenance
- f. Long term maintenance
- g. Out of season lay up procedures
 - i. processes required ensuring that the machine is left in a safe and suitable condition to be stored for the out of season period
 - ii. cleaning and servicing
 - iii. corrosion prevention
 - iv. protection from weather
 - v. protection from vermin
- h. Pre-season
 - i. inspection procedures
 - ii. compliance with legislation
 - iii. compliance with manufacturers' specifications
 - iv. lubrication
 - v. common causes of component and assembly failure
 - vi. repair procedures
 - vii. replacement of worn components
 - viii. safe practices
 - ix. clearances settings
 - x. spring pressures
 - xi. timing
- i. Post-season
 - i. corrosion protection
 - ii. common causes of component and assembly failure
 - iii. identification of worn components
 - iv. cleaning

Control of and specification of Crop Processing Mechanisms in Harvesting Machinery

- a. Crop processing
 - i. threshing
 - ii. cleaning
 - iii. crimping
 - iv. separating
 - v. conveying
 - vi. tying and wrapping.
- b. Specification
 - i. as laid down by the machine manufacturer in operator's manuals
 - ii. workshop manuals
 - iii. technical bulletins
 - iv. spacing
 - v. width
 - vi. material capacity
 - vii. options
 - viii. speeds
 - ix. electronic monitoring
 - x. hydraulic controls
 - xi. machine protection devices
 - xii. costs.

Content:

- c. Work rates
 - i. spot
 - ii. effective
 - iii. field efficiency
 - iv. factors affecting efficiency
 - v. material volume limitations
 - vi. material
 - vii. losses
 - viii. loss control
 - ix. appropriate calculations
- d. Machine compatibility
 - i. uses
 - ii. sequence in field operations
 - iii. rows
 - iv. power requirement
 - v. operational limitations
 - vi. condition/quantity of material input
 - vii. suitability for different crop and surface conditions.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none"> • Maintenance procedures to harvesting machinery
<ul style="list-style-type: none"> • Adjustments to processing mechanisms
<ul style="list-style-type: none"> • Identifying and rectifying a fault on harvesting machinery
<ul style="list-style-type: none"> • Out of season lay up

Evidence from simulated activities is acceptable for this unit.



UNIT LEO320 - WORKING WITH LAND-BASED DIESEL FUEL INJECTION SYSTEMS

Level: 3	Credit Value: 10	GLH: 60
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Mapping: This unit is linked to the Land based service engineering NOS

Rationale: This unit aims to provide learners with an understanding of diesel fuel injection systems to enable service, diagnostics and repair and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand diesel fuel types, systems and components used in land based vehicles	1.1. Explain the layout of diesel fuel injection systems used in land based vehicles 1.2. Explain how commonly used cold starting aids function 1.3. Explain the importance of filtration of diesel fuel and air
2. Know the components that are employed in land based vehicle diesel fuel injection systems	2.1. Describe the working principles of components used in diesel fuel injection systems 2.2. Describe the working principle of a mechanical fuel injector 2.3. Describe the working principles of selected mechanical fuel injection pumps
3. Be able to carry out routine service, testing and repairs to diesel fuel injection systems	3.1. Carry out routine service and testing of diesel fuel injection systems 3.2. Produce a report to outline the serviceability of a given diesel fuel injection system 3.3. Carry out non scheduled repairs and maintenance to a diesel fuel injection system
4. Understand methods by which engine management systems control engine performance and emissions	4.1. Explain what factors ensure diesel fuel is used efficiently to comply with current emissions regulations 4.2. Compare different types of diesel fuel injectors and the effect they have on fuel combustion 4.3. Justify the development of electronic control of injection systems and how they are integrated into electronic engine management systems

Content:

Understand diesel fuel types, systems and components used in land-based vehicles

- a. Diesel fuel
 - i. white diesel (EN590)
 - ii. rebated heavy oil (Red BS2869)
 - iii. bio-diesel
- b. Layouts
 - i. fuel tank
 - ii. lift pump
 - iii. primary and secondary filtration systems
 - iv. in-line fuel injection pumps
 - v. rotary injection pumps
 - vi. unit injectors
 - vii. electronic systems
 - viii. common rail
 - ix. injector pipes
 - x. cold starting aids
 - xi. fuel return line.

Know the components that are employed in land-based vehicle diesel fuel injection systems

- a. Systems
 - i. conventional diesel fuel injection systems
 - ii. pressure/timed fuel injection systems
 - iii. combined pump/injector fuel injection systems
 - iv. electronically controlled systems
- b. Pumps
 - i. in line
 - ii. rotary
 - iii. individual
 - iv. high pressure common rail
 - v. pump drive and timing arrangements
 - vi. injectors
 - vii. single hole
 - viii. multi-hole
 - ix. pintle
 - x. pintaux
 - xi. single stage
 - xii. two stage
 - xiii. electronic-type
- c. Cold start devices
 - i. glow plug
 - ii. grid heater
 - iii. thermostart devices
 - iv. donkey engine
 - v. block heaters
- d. Filtration
 - i. air / fuel
 - ii. size
 - iii. microns
 - iv. water elimination
 - v. centrifugal
 - vi. fibre / paper etc.
 - vii. plate
 - viii. foam,
 - ix. cotton gauze
 - x. oil bath

Content:

Routine service, testing and repairs to diesel fuel injection systems

- a. Maintenance
- b. Service schedules
- c. Venting and checking the condition of the complete fuel injection system
- d. Removal and refitting of fuel injection system components
- e. Methods of checking and adjusting fuel injection pump/engine timing
- f. Use of manufacturers' service manuals and data
- g. Fault diagnosis
- h. Symptoms and common causes of excessive smoke emissions
- i. Poor starting
- j. Poor engine performance
- k. Fuel leaks and air ingress
- l. Methods and equipment used in fault diagnosis
- m. Methods used to analyse test data.
- n. Health and safety
- o. Personal protective equipment (PPE)
- p. Risk assessments
- q. Relevant current legislation
- r. Health and Safety at Work etc Act 1974
- s. Control of Substances Hazardous to Health Regulations 2002 (COSHH)
- t. Provision and Use of Work Equipment Regulations 1998 (PUWER).

Understand methods by which engine management systems control engine performance and emissions

- a. Governors and engine management systems
 - i. mechanical
 - ii. hydraulic pneumatic
 - iii. electronic;
 - i. electronic engine management systems
 - ii. injectors
 - iii. single hole
 - iv. multi-hole
 - v. pintle
 - vi. pintaux,
 - vii. single stage
 - viii. two stage
 - ix. electronic-type
 - x. uses
 - xi. costs
 - xii. advantages
 - xiii. disadvantages
 - xiv. reliability
 - xv. relevant current emissions legislation
 - xvi. European stage emission ratings
 - xvii. American tier ratings
 - xviii. date of implication
 - xix. particles
 - xx. nitrous oxides
 - xxi. carbon monoxides
 - xxii. hydro carbons
 - xxiii. exhaust gas recirculation
 - xxiv. selective catalytic reduction systems



Evidence Requirements

- | |
|---|
| 1. You must produce evidence of carrying out routine servicing and testing of a diesel fuel system. |
| 2. You must produce evidence of successfully carrying out the diagnosis and rectification of a diesel fuel system fault. The fault should involve a 2 or more step diagnostic activity. |

Evidence from simulated activities is acceptable for this unit



UNIT LEO321 - FAMILIARISATION AND MANAGEMENT OF LAND-BASED VEHICLES

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the National Occupational Standards for Land-based Engineering		
Rationale: This unit aims to introduce learners to land-based vehicle management skills and knowledge 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the specialist features and characteristics of commonly used land-based vehicles	1.1. Explain specialist features and characteristics of selected commonly-used land-based vehicles 1.2. Analyse machine specifications for selected land-based machines
2. Know the legal constraints governing the operation and use of land-based vehicles	2.1. Describe the legal constraints associated with the operation and use of given land-based vehicles 2.2. Identify safety features in the design of land-based vehicles
3. Be able to operate land-based vehicles to allow service and repair tasks to be performed	3.1. Operate given land-based vehicles in confined spaces to allow service and repair tasks to be performed 3.2. Undertake risk assessment appropriate to vehicle operation
4. Understand the managerial aspects of ownership of land-based vehicles	4.1. Explain managerial aspects of land-based vehicle ownership 4.2. Discuss service and maintenance planning for selected land-based vehicles

Content:

Specialist features and characteristics of commonly used land-based vehicles

- a. Land based vehicles
- b. Hand held
- c. Pedestrian
- d. Self propelled
- e. Mounted, trailed machines
- f. Medium to high powered
- g. 2WD
- h. 4WD
- i. High visibility
- j. Articulated
- k. Track laying
- l. Steel tracked
- m. Rubber tracked

Content:

- n. Materials handlers
 - i. telescopic handlers
 - ii. skid steer loaders
 - iii. tractor mounted loaders
 - iv. wheeled loading shovels
 - v. specialist
 - vi. all-terrain vehicles (ATVs)
 - vii. systems vehicles
 - viii. tool carriers
 - ix. high speed (HVMs)
 - x. compact LBVs.
- o. Machine specifications
 - i. size
 - ii. weight
 - iii. engine size
 - iv. type
 - v. drive line

Legal constraints governing the operation and use of land-based vehicles

- a. Using LBV's on the road
 - i. type
 - ii. size
 - iii. speed
 - iv. weight
 - v. special requirements
 - vi. highway code
- b. Licensing
 - i. age of operators
 - ii. licence requirements
 - iii. licence limitations
 - iv. training and certification
- c. Health and safety
 - i. safety features
 - ii. ROPS (rollover protective structure) with seatbelt
 - iii. posture-designed seat
 - iv. lighting for highway and field,
 - v. SMV (slow moving vehicle) sign
 - vi. flashing amber hazard lights
 - vii. turn signals
 - viii. fenders
 - ix. engine shrouding
 - x. PTO master shield
 - xi. PTO stub shaft shield
 - xii. manual override power steering
 - xiii. neutral start interlocking switch
 - xiv. steps with handholds
 - xv. hazard warning decals
 - xvi. breakaway hydraulic couplers
 - xvii. machine tests/certificates
 - xviii. safety features
 - xix. operating environment
- d. Preparation for work
 - i. field use
 - ii. road use
 - iii. use of implements
- e. Ergonomics
 - i. driver comfort
 - ii. manufacturers' requirements and obligations
 - iii. controls
 - iv. visibility.

Content:

Operation of land-based vehicles to allow service and repair tasks to be performed

- a. Preparation for work
 - i. instruments and controls
 - ii. starting
 - iii. stopping
 - iv. instrumentation
 - v. operator checks
 - vi. machine condition
- b. Operation
 - i. driving in appropriate conditions
 - ii. operation in confined spaces
 - iii. post- operational tasks
 - iv. health and safety, risk assessment.
- c. Attachments
 - i. commonly used implements/fittings
 - ii. attachment
 - iii. detachment
- d. Service and repair tasks
 - i. daily
 - ii. weekly
 - iii. monthly
 - iv. annual service
 - v. wearing part replacement
 - vi. breakdown repair
- e. Risk assessment

Managerial aspects of ownership of land-based vehicles

- a. Managerial aspects:
 - i. complying to laws and legislation
 - ii. costing
 - iii. planning servicing
 - iv. planning replacement
 - v. purchase options
 - vi. maintenance
 - vii. operational
 - viii. fuel
 - ix. tyres
 - x. ownership costs
 - xi. service costs
 - xii. depreciation
 - xiii. service and maintenance
 - xiv. routine inspection
 - xv. servicing and replacement of wearing parts
 - xvi. interpretation of maintenance schedules
 - xvii. service schedules
 - xviii. timing.

Evidence Requirements

- | |
|---|
| 1. You must produce evidence of operating land-based vehicles in confined spaces to allow maintenance to take place. |
| 2. You must produce evidence of carrying out a risk assessment appropriate to that vehicle operation. |

Evidence from simulated activities is acceptable for this unit.



UNIT LEO322 - WORKING WITH LAND-BASED MACHINERY (APPLICATION EQUIPMENT)

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS.		
Rationale: This unit aims to introduce learners to the skills and knowledge required for working with land-based application 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the function of land based application equipment	1.1. Explain the function of a given range of land based application machines 1.2. Explain the operating principles of a given range of land based application machines 1.3. Compare the operating principles of application machines designed for similar purpose but use different engineering solutions
2. Be able to prepare land based application equipment for field use	2.1. Prepare given application machines for field operations 2.2. Carry out routine service tasks according to Manufacturers instructions 2.3. Report on the condition of given land based application machines
3. Be able to test, overhaul and repair land based application machines	3.1. Set and adjust given digital control systems
4. Be able to operate land based application equipment	4.1. Plan field procedures and assess risks prior to meeting field operation objectives 4.2. Carry out adjustments and settings to meet specific work rates and targets using identified application equipment 4.3. Report on quality of work and suggest how changes to procedures and settings could improve the quality and efficiency of work

Content:
Application equipment

- a. Crop sprayers
- b. Fertilizer spreaders
- c. Slug pellet applicators
- d. Seed drills
- e. Solid and liquid manure spreaders
- f. Root crop planting equipment
- g. Planters and transplanters
- h. Irrigation equipment

Function of land based application equipment

- a. The principles by which the identified application equipment achieves the required goal including
 - i. feed mechanisms
 - ii. control mechanisms
 - iii. liquid flow
 - iv. air flow
 - v. application rates
 - vi. forward speed
 - vii. pressure
 - viii. depth control
 - ix. height control flow rates
 - x. liquid pesticide application
 - xi. hydraulic nozzle sprayer
 - xii. controlled droplet application
 - xiii. variable geometry boom
 - xiv. air assisted and boom sleeved sprayers
 - xv. granular/powder application
 - xvi. single and twin spinning discs
 - xvii. oscillating spout
 - xviii. pneumatic boom
- b. Manure and slurry spreaders
 - i. rear discharge
 - ii. rotary
 - iii. vacuum fill-pressure discharge tankers
 - iv. pump fill-pump discharge tankers
 - v. waste and rain water distribution
- c. Irrigation equipment
 - i. pumps
 - ii. irrigation pipes and meters
 - iii. hose reels irrigators
 - iv. centre pivot irrigators
 - v. rain gun distributors
 - vi. boom applicator units.
- d. The different mechanisms used by application equipment to achieve the required goal to include
 - i. fluid pressure
 - ii. vacuum
 - iii. belts
 - iv. chains
 - v. wheels
 - vi. rollers
 - vii. discs
 - viii. tines
 - ix. flow rates.

Content:
Prepare land based application equipment for field use

- a. Prepare machinery for field use
 - i. removal from storage
 - ii. decontamination and cleaning
 - iii. correct connection to suitable power unit
 - iv. lubrication
 - v. service schedule
 - vi. manufacturers' recommendations
 - vii. planning service around fieldwork requirements
 - viii. service records
 - ix. warranty constraints
 - x. component and load security
 - xi. component modification and substitution
 - xii. safe working practices
 - xiii. health and safety issues
 - xiv. contamination
 - xv. pollution
 - xvi. risk assessments
 - xvii. PPE
- b. Routine service tasks
 - i. ensure the equipment is fit for work
 - ii. short and medium term including lubrication
 - iii. movement checks
 - iv. leaks
 - v. component speed
- c. Condition
 - i. suitability
 - ii. working order
 - iii. freedom from leaks
 - iv. damaged components.

Test, Overhaul and Repair land based application machines

- a. Test application equipment
 - i. check driveline operation
 - ii. check controls and adjustments
 - iii. run to working speed
 - iv. sensory checks
 - v. calibration checks
 - vi. overhaul and repair application equipment
 - vii. damage
 - viii. wear
 - ix. corrosion
 - x. linkage
 - xi. hydraulics
 - xii. electrical equipment
 - xiii. mechanical drivelines
 - xiv. safety overload protection devices
 - xv. bearings
 - xvi. seals
 - xvii. valves
 - xviii. repair overhaul/remanufacture decisions
 - xix. fit for purpose
 - xx. repair strategies
 - xxi. safe working practices
 - xxii. health and safety issues
 - xxiii. contamination
 - xxiv. pollution
 - xxv. correct disposal of waste.

Content:

Operation of land based application equipment

- a. Operation of the equipment in a variety of field conditions
 - i. wind direction
 - ii. water courses
 - iii. environmental features
 - iv. power lines
 - v. obstacles
- b. Hydraulic nozzle sprayer
 - i. check liquid flow
 - ii. pressures
 - iii. clean filters
 - iv. select and fit nozzles
 - v. operate controls
 - vi. set up for application rates
 - vii. calibrate
 - viii. field procedures
- c. Granule/powder distributor
 - i. correct linkage settings
 - ii. material flow rate adjustments
 - iii. balance of spread
 - iv. spread widths
 - v. calibration
 - vi. field procedures
 - vii. headland attachments
- d. Manure and slurry spreaders
 - i. filling procedures rotor speeds
 - ii. chain attachments
 - iii. safe start-up procedures
 - iv. forward speed
 - v. pollution controls
 - vi. feed gate settings
 - vii. apron conveyor speeds
 - viii. field procedures
 - ix. contamination
 - x. pollution
 - xi. decontamination
 - xii. preparation for storage
 - xiii. correct disposal of waste.

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Prepare application machine for field operations
<ul style="list-style-type: none"> • Routine maintenance activities on application equipment
<ul style="list-style-type: none"> • Set and adjust given digital control systems
<ul style="list-style-type: none"> • Adjustments and settings to meet specification on application equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on application equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LE0323 - UNDERSTANDING AND WORKING WITH LAND-BASED VEHICLE ENGINE TECHNOLOGY

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based Engineering National Occupational Standards		
Rationale: This unit aims to introduce learners to the skills and knowledge in vehicle engine technology 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the construction and operation of commonly used land-based vehicle compression ignition and spark ignition engines	1.1. Explain the construction and operation of a compression ignition engine 1.2. Explain the construction and operation of a spark ignition engine; both two and four stroke
2. Understand the construction and operation of associated land-based vehicle engine ancillary systems	2.1. Explain the construction and operation of the lubrication system 2.2. Explain the construction and operation of the cooling system; both air and liquid 2.3. Explain the construction and operation of the fuel system; both diesel and petrol 2.4. Explain the construction and operation of the electrical system
3. Be able to test and diagnose faults in land-based vehicle engines and their ancillary systems	3.1. Safely carry out testing procedures using manufacturers' service data 3.2. Report on status of engine and ancillary equipment
4. Be able to maintain and repair land-based vehicle engines and their ancillary systems	4.1. Safely carry out (using manufacturers' service data) routine maintenance of engines and associated ancillary equipment 4.2. Safely service and repair selected land-based engines and ancillary equipment

Content:

Construction and Operation of commonly used land-based vehicle Compression Ignition and Spark Ignition Engines

- a. Construction
 - i. engine block
 - ii. crankshaft
 - iii. con-rods
 - iv. pistons
 - v. piston rings
 - vi. cylinder liners (wet, dry)
 - vii. timing drives
 - viii. flywheel
 - ix. balancer units
 - x. cylinder head
 - xi. head gasket
 - xii. valve guides,
 - xiii. inlet and exhaust manifolds
 - xiv. valve train
 - xv. camshaft
 - xvi. cam followers
 - xvii. pushrods
 - xviii. rocker shaft
 - xix. rocker arms
 - xx. valves
 - xxi. valve springs
- b. Cylinder numbers
 - i. engine configuration
 - ii. inline
 - iii. vee
- c. Materials used
 - i. cast
 - ii. steel
 - iii. aluminium
- d. Cycles of Operation
 - i. two-stroke spark ignition
 - ii. four-stroke compression and spark ignition
 - iii. Internal combustion engines
 - iv. compression ignition (CI)
 - v. spark ignition (SI)
 - vi. naturally aspirated
 - vii. turbocharged
- e. Engine terminology
 - i. valve timing diagrams
 - ii. compression ratio
 - iii. compression pressure
 - iv. combustion pressure
 - v. volumetric efficiency
 - vi. swept volume
 - vii. engine capacity
- f. Engine characteristics
 - i. speed
 - ii. power
 - iii. torque
 - iv. noise levels
 - v. economy
 - vi. exhaust emissions.

Content:

- g. Ignition systems
 - i. function
 - ii. magneto ignition system
 - iii. flywheel
 - iv. coil
 - v. contact breakers
 - vi. condenser
 - vii. primary circuit
 - viii. secondary circuit
 - ix. sparking plug
 - x. coil ignition system
 - xi. battery
 - xii. coil
 - xiii. ignition switch
 - xiv. contact breakers
 - xv. condenser
 - xvi. primary circuit
 - xvii. secondary circuit
 - xviii. distributor cap
 - xix. rotor arm
 - xx. sparking plug
- h. Electronic ignition systems
 - i. Inductive
 - ii. hall effect
 - iii. capacitor discharge
 - iv. distributor-less ignition
 - v. advantages and disadvantages of different systems
 - vi. common causes of system failure.

Construction and Operation of associated land-based vehicle engine ancillary Systems

- a. Lubrication system
 - i. function
 - ii. sump
 - iii. pump
 - iv. pressure relief valve
 - v. filter
 - vi. oil cooler
 - vii. oil flow diagram
 - viii. lubricant
 - ix. properties
 - x. advantages and disadvantages of different systems
 - xi. common causes of system failure
 - xii. force feed
 - xiii. splash feed.
- b. Liquid
 - i. function
 - ii. air cooling systems e.g. fans, ducting, jackets and shrouds, fins
 - iii. liquid cooling systems e.g. radiator, thermo-syphon, expansion tank, pressure cap, water pump, fan and belt, electric fan, viscous fan; thermostat, hoses, coolant circulation, anti-freeze; cab heater; advantages and disadvantages of different systems; common causes of system failure
- c. Thermostat
 - i. bypass
 - ii. radiator
 - iii. water jacket
 - iv. impeller
 - v. fan
 - vi. fan drive
 - vii. belt
 - viii. electric motor
 - ix. thermo-coupled.

Content:

- a. Fuel system diesel
 - i. fuel tank
 - ii. sedimenters
 - iii. agglomerators
 - iv. water stops
 - v. lift pumps
 - vi. priming pumps
 - vii. in-line fuel injection pumps
 - viii. rotary fuel injection pumps
 - ix. pressure/time fuel systems
 - x. common rail fuel systems
 - xi. mechanical fuel injectors
 - xii. electronic injectors
 - xiii. unit injectors
 - xiv. metering devices
 - xv. sensors
 - xvi. electronic control unit
 - xvii. mechanical control (governors)
 - xviii. cold start aids
 - xix. air filtration, air filter restriction indicators;
- b. Petrol fuel system
 - i. tank
 - ii. fuel pump
 - iii. fuel filter
 - iv. carburettor
 - v. float chamber
 - vi. single diaphragm
 - vii. double diaphragm fuel injection
 - viii. sensors
 - ix. electronic control.
- c. Electrical system
 - i. alternator
 - ii. dynamo
 - iii. magneto
 - iv. solid state
 - v. engine sensors
 - vi. starter
 - vii. fuses
 - viii. lights
 - ix. bulbs
 - x. relays.
- d. Operation
 - i. the way the above components work individually and as part of the system.

Test and Diagnose faults in land-based vehicle engines and their ancillary systems

- a. Safety
 - i. as required by recognised procedures and risk assessment
- b. Report
 - i. written
 - ii. verbal
- c. Ancillary equipment
 - i. alternator
 - ii. dynamo
 - iii. starter motor
- d. Status
 - i. serviceable
 - ii. non serviceable
 - iii. manufacturers specification
 - iv. engine (2 stroke, four stroke, diesel, petrol)

Content:

Testing procedures e.g. visual, dynamic, electronic

- a. Use of appropriate equipment
 - i. dynamometer
 - ii. compression cylinder leakage tester
 - iii. fuel injection testing equipment
 - iv. engine oil pressure and temperature gauges
 - v. coolant system leakage testers
 - vi. exhaust gas analysis
 - vii. use of 'on-board' and remote ict test equipment
 - viii. methods used to analyse test data
 - ix. use of manufacturers' service manuals and data
 - x. health and safety; risk assessment
 - xi. relevant and current legislation.

Maintain and Repair land-based vehicle engines and their ancillary systems

- a. Routine maintenance
 - i. reasons for maintenance
 - ii. servicing and repair
 - iii. use of manufacturers' service manuals and data
 - iv. methods used to maintain
 - v. service and repair or replace engines and ancillary systems as per manufacturers' instructions
 - vi. methods used to check the integrity of maintenance
 - vii. service and repair activities
 - viii. health and safety
 - ix. risk assessment
 - x. relevant current legislation

Evidence Requirements

1. You must produce evidence of carrying out diagnosis and rectification activities from 3 different engine systems out of the 7 listed below* . The fault should involve a 2 or more step diagnostic activity.
Engine Mechanical System
Engine Management Systems
Fuel System
Lubrication System
Ignition System
Cooling System
Pressure Charged Induction System

*However, you must prove to your assessor that you have the necessary knowledge and understanding to be able to perform competently in respect of faults occurring in all the types of systems.

Evidence from simulated activities is acceptable for this unit.



UNIT LE0324 - UNDERSTANDING COMPUTER APPLICATION AND CONTROL IN LAND-BASED TECHNOLOGY

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based Service Engineering NOS		
Rationale: This unit aims to introduce learners to the skills and knowledge in land-based computer application and control systems 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the application and operation of components used in land-based computer application and control systems	1.1. Identify the main component parts of given digital control systems 1.2. Explain the operation and interaction of given digital control systems
2. Understand the function of land-based computer application and control systems	2.1. Explain the function of selected application and control systems 2.2. Explain the operation of selected application and control systems
3. Be able to set and adjust land-based computer application and control systems	3.1. Set and adjust given digital control systems
4. Be able to test and repair land-based computer application and control systems	4.1. Carry out test procedures in given computer application and control systems 4.2. Repair faults found in given computer application and control systems 4.3. Collect and collate test data to assess the condition of selected computer application and control components

Content:

Application and Operation of components used in land-based computer application and control systems

- a. Digital control systems
 - i. engine
 - ii. suspension
 - iii. transmission
 - iv. power take off
 - v. hydraulic
 - vi. steering
 - vii. application control
- b. Processes
 - i. types of processes capable of being controlled and/or monitored e.g. position control, draft control, velocity, temperature, level, mass, flow, rev/min, sequences of operation, health and safety
- c. Main component parts:
 - i. typical sensors, e.g. pressure, velocity, strain, flow, proximity, displacement, vibration, temperature, RPM, force, position, shock
- d. Need to change signal type (signal conditioning systems) within a system
 - i. voltage-to-voltage
 - ii. voltage-to-current
 - iii. analogue-to-digital
 - iv. digital-to-analogue
 - v. block diagrams
- e. Processors /digital control unit
 - i. ECU
 - ii. ECM
 - iii. Canbus system
 - iv. function of the main blocks in a digital controller e.g. central processor unit, memory, input output interfaces
- f. Signal convertors
 - i. voltage to voltage
 - ii. voltage to current
 - iii. analogue to digital
 - iv. digital to digital
- g. Displays
 - i. LCD
 - ii. Colour
 - iii. LED
 - iv. warning light
 - v. analogue gauge
 - vi. typical display types e.g. light emitting diode, liquid crystal, video display unit, bar graph, analogue meter
- h. Operation and interaction
 - i. how the controllers talk to each other and receive signals from sensors, and operators.

Function of land-based computer application and control systems

- a. Application and control systems
 - i. engine
 - ii. suspension
 - iii. transmission
 - iv. power take off
 - v. hydraulic
 - vi. steering
- b. Application control of
 - i. liquid
 - ii. pills
 - iii. compounds
- c. Function
 - i. signal generation and transmission
 - ii. how these signals are translated, and into what

Content:

- d. End result of
 - i. the signal
 - ii. input and output signals of each of the blocks in a typical digital control system e.g. level control, speed sensing, position sensing, and temperature control
- e. Display
 - i. quantity being controlled e.g. seven segment displays
 - ii. liquid crystal
 - iii. video display unit
- f. Operation
 - i. how the components interact with each other potential malfunction conditions
 - ii. health and safety.

Set and Adjust land-based computer application and control systems

- a. System set up and primary calibrations.
- b. Calibration/adjustment of a typical system: e.g. position control sensor calibration, position control, level control, speed sensing, temperature control
- c. How the system compensates for differing received signals from sensors, and operator adjustments
- d. Health and Safety
- e. Digital control systems
 - i. engine
 - ii. suspension
 - iii. transmission
 - iv. power take off
 - v. hydraulic
 - vi. steering
 - vii. application control

Test and Repair land-based computer application and control systems

- a. Application and control systems
 - i. engine
 - ii. suspension
 - iii. transmission
 - iv. power take off
 - v. hydraulic
 - vi. steering
- b. Application control of
 - i. liquid
 - ii. pills
 - iii. compounds
- c. Test procedures
 - i. voltage
 - ii. current
 - iii. resistance checks
 - iv. retrieving error codes
 - v. using laptop and manufacturer's software to run test programmes (use of instruments e.g. multi-meter, oscilloscope, fault code readers, gas analysers)
- d. Faults
 - i. faults in power supply
 - ii. sensor
 - iii. transducer
 - iv. malfunction indicator lamps
 - v. error codes
 - vi. warning lights
 - vii. audible warning
 - viii. components not working
- e. Collect and collate test data
 - i. data logging
 - ii. error codes
 - iii. manual logging of data
 - iv. remote data collection.



Evidence Requirements

- | |
|---|
| 1. You must produce evidence of setting and adjusting a digital application and control system |
| 2. You must produce evidence of carrying out the diagnosis and rectification of a computer application and control system fault. The fault should involve a 2 or more step diagnostic activity. |

Evidence from simulated activities is acceptable for this unit.

**UNIT LE0325 - UNDERTAKING LAND-BASED TECHNOLOGY ENGINEERING DRAWING****Level: 3****Credit Value: 10****GLH: 60****Mapping:** This unit is linked to the Land-based Service Engineering NOS**Rationale:** This unit aims to introduce learners to the skills and knowledge in the creation of three-dimensional objects accurately through the drawing of two-dimensional views. They will consider orthographic projection, the design process and methods of presenting engineering design ideas 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.

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Be able to produce and interpret engineering drawings in isometric and orthographic projection	1.1. Produce and interpret engineering working drawings in isometric and orthographic projection to meet given objectives
2. Be able to produce geometrical constructions	2.1. Produce geometrical constructions from working drawings
3. Understand the overall concept of the design process and the role of the engineering drawing office	3.1. Explain the design process 3.2. Discuss the role of the engineering drawing office
4. Be able to produce presentation drawings	4.1. Produce manual presentation drawings of a selected product or design to meet given objectives

Content:**Produce and interpret engineering drawings in isometric and orthographic projection**

- a. Engineering working drawings
 - i. drawings representing a machine or component normally drawn in first and third angle projections
 - ii. electrical/electronic circuit layouts
 - iii. hydraulic layouts
 - iv. common drawing conventions (drawing layout and presentation)
 - v. line types
 - vi. hidden detail and sectioning
 - vii. dimensions and tolerances
 - viii. surface finish
 - ix. limits
 - x. symbols
- b. Isometric projection
 - i. Isometric drawings presenting designs/drawings in three dimensions
- c. Orthographic projection:
 - i. Drawing a 3D object in 2D from different directions, usually a front, side and plan.

Content:

Produce geometric constructions

- a. Geometric constructions
 - i. drawing precise drawings using a compass and a straight edge
 - ii. bisection of an angle
 - iii. division of a straight line (into two and more than three divisions)
 - iv. tangents (normal to radius of a circle, common to two circles)
- b. Moving parts
 - i. cams
 - ii. loci of a point (robot arm movements, slider crank, quick-return mechanism).

Overall concept of design process and the role of the engineering drawing office

- a. Design Process
 - i. the process involved in taking a design brief
 - ii. designing and developing the end product (using development techniques such as brainstorming, free-hand sketching, research, producing and testing prototypes)
 - iii. presenting final design and planning production using manual or computer-based methods
- b. Role of the drawing office
 - i. role and responsibilities of drawing/design office within a manufacturing company.

Produce presentation drawings

- a. Presentation drawings
 - i. isometric including circles and curves
 - ii. oblique
 - iii. 3D
 - iv. computer-aided design (CAD)

Evidence Requirements

1. You must produce evidence of carrying out engineering orthographic and isometric projection drawings
2. You must produce evidence of carrying out geometrical constructions
3. You must produce evidence of carrying out presentation 3D drawings using computer aided design (CAD) software

Evidence from simulated activities is acceptable for this unit.



**UNIT LEO326 - UNDERSTANDING AND SERVICING LAND-BASED HARVESTING MACHINERY
CUTTING AND LIFTING**

Level: 3	Credit Value: 10	GLH: 10 (60)
Mapping: This unit is linked to the Land-based Service Engineering NOS		
Rationale: The aim of this unit is to provide the learner the understanding required for the maintenance and repair of cutting and lifting mechanisms of harvesting machinery and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the principles of crop cutting and lifting in land based harvesting machinery	1.1. Explain the principles of crop cutting and lifting in harvesting machinery 1.2. Explain how cutting and lifting mechanisms accommodate varying crops and crop conditions
2. Be able to carry out 'preparation for work' procedures on crop cutting and lifting mechanisms in harvesting machinery	2.1. Carry out adjustments to enable crop cutting and lifting mechanisms to give optimal performance in a range of crops and crop conditions
3. Be able to carry out maintenance, repair and 'out of season lay up' procedures on crop cutting and lifting mechanisms in harvesting machinery	3.1. Carry out maintenance procedures on crop cutting and lifting mechanisms 3.2. Carry out procedures to identify and rectify faults on crop cutting and lifting mechanisms 3.3. Carry out 'out of season lay up' procedures to crop cutting and lifting mechanisms
4. Understand the 'control of' and specification of crop cutting and lifting mechanisms in harvesting machinery	4.1. Explain the operator control procedures of crop cutting and lifting mechanisms 4.2. Explain the specification data of crop cutting and lifting mechanisms

<p>Content:</p> <p>Harvesting machinery</p> <ol style="list-style-type: none"> a. Cereal b. Green crop harvesters c. Root crop harvesters d. Timber harvesters <p>Principles of crop cutting and lifting in land based harvesting machinery</p> <ol style="list-style-type: none"> a. Cutting mechanisms <ol style="list-style-type: none"> i. rotary ii. reciprocating and oscillating drum iii. disc iv. rotary blade v. rigid blade/bar vi. flail vii. reciprocating knife viii. flywheel ix. cylinder.
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Content:

- b. Lifting mechanisms
 - i. belts
 - ii. augers
 - iii. rollers
 - iv. shares elevators
 - v. wheels
 - vi. reel
 - vii. tine
 - viii. disc

- c. Crops
 - i. cereal
 - ii. green crops
 - iii. root crops
 - iv. timber

- d. Crop conditions
 - i. damp
 - ii. dry
 - iii. standing
 - iv. laid
 - v. sparse
 - vi. dense

'Preparation for Work' procedures on crop cutting and lifting mechanisms in harvesting machinery

- a. Optimum performance
 - i. as set out in manufacturers guidance and advice
 - ii. as required by further processing
 - iii. storage or customer requirements
 - iv. appropriate to crop
 - v. weather and ground conditions
- b. Workshop settings
 - i. manufacturers' manuals and data
 - ii. attachment
 - iii. drive-line
 - iv. height
 - v. speed
 - vi. levels
 - vii. operation of controls
 - viii. timing of components
 - ix. chop length
 - x. alignment
 - xi. attachments/options
 - xii. health and safety
 - xiii. risk assessment
 - xiv. personal protective equipment (PPE)
 - xv. relevant current legislation e.g. Health and Safety at Work Act 1974, Control of Substances Hazardous to Health Regulations (COSHH)
- c. Operational settings
 - i. depth
 - ii. height
 - iii. levels
 - iv. alignment
 - v. speed
 - vi. material flow
 - vii. health and safety
 - viii. risk assessment
 - ix. ppe
 - x. relevant current legislation.

Content:

Maintenance, Repair and 'out of season lay up' procedures on crop cutting and lifting mechanisms in harvesting machinery

- a. Maintenance procedures
 - i. as specified in manufacturers guidance
 - ii. workshop manuals
 - iii. operator manual
 - iv. maintenance can be daily
 - v. short term or long term
 - vi. pre-season
 - vii. inspection procedures
 - viii. lubrication
 - ix. common causes of component and assembly failure
 - x. repair procedures (replacement of worn components, safe practices, sharpening, re-bevelling, clearance setting)
 - xi. post-season
 - xii. corrosion protection
 - xiii. common causes of component and assembly failure
 - xiv. identification of worn components
 - xv. cleaning
 - xvi. protection from weather
 - xvii. protection from vermin.
 - xviii. as specified by machine manufacturers
 - xix. faults
 - xx. major
 - xxi. minor
 - xxii. harvesting.

'Control of' and specification of crop cutting and lifting mechanisms in harvesting machinery

- a. Work rates
 - i. spot
 - ii. effective
 - iii. field efficiency
 - iv. factors affecting efficiency
 - v. material volume limitations
 - vi. material
 - vii. losses
 - viii. loss control
 - ix. appropriate calculations
- b. Specification
 - i. width
 - ii. material capacity
 - iii. options
 - iv. speeds
 - v. electronic monitoring
 - vi. hydraulic controls
 - vii. machine protection devices
 - viii. costs
 - ix. spacing
- c. Machine compatibility
 - i. uses
 - ii. sequence in field operations
 - iii. rows
 - iv. beds
 - v. power requirement
 - vi. suitability for different plant and surface conditions - damp, dry, standing, laid, sparse, dense.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none">• Maintenance procedures to cutting and lifting equipment
<ul style="list-style-type: none">• Adjustments to processing mechanisms
<ul style="list-style-type: none">• Identifying and rectifying a fault on cutting and lifting equipment
<ul style="list-style-type: none">• Out of season lay up

Evidence from simulated activities is acceptable for this unit.



UNIT LEO327 - UNDERSTANDING AND SERVICING LAND-BASED MACHINES CULTIVATION AND PLANTING EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS.		
Rationale: This unit aims to introduce learners to the skills and knowledge involved in the construction, operation and servicing of machines designed to prepare seedbeds and plant seeds 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the operation and function of land based cultivation and planting machines	1.1. Compare the function of a given range of cultivation and planting machines 1.2. Explain the operating principles of a range of cultivation and planting machines 1.3. Evaluate a range of available machines which have similar functions but use different operating principles
2. Be able to carry out routine service and non routine maintenance to land based cultivation and planting machines	2.1. Carry out routine service tasks to a given range of machines in accordance with manufacturers schedules 2.2. Carry out non routine maintenance tasks to a given range of machines which are not outlined in manufacturers service schedules 2.3. Discuss the consequences on the performance of cultivation and planting machines that have not been subjected to adequate service and maintenance
3. Be able to carry out inspection and overhaul procedures on land based cultivation and planting machines	3.1. Produce condition reports on a given range of cultivation and planting machines 3.2. Carry out distortion and alignment checks on a given range of cultivation and planting machines 3.3. Carry out overhaul procedures to a given range of cultivation and planting machines
4. Understand how machines produce different seedbeds to cater for different crops and planting techniques	4.1. Prepare a given range of cultivation and planting machines for work 4.2. Operate and adjust a given range of machines to achieve given objectives 4.3. Evaluate the quality of work and work rates of a given range of cultivation and planting machines when subjected to different settings and conditions

Content:
Operation and function of landbased cultivation and planting machines

- a. Cultivation machinery
 - i. powered
 - ii. non powered cultivation equipment including primary and secondary (subsoilers and mole ploughs, mouldboard ploughs, disc harrows, rigid tine cultivators, spring tine cultivators, seed harrows, arable rolls and presses (single and double)
 - iii. powered cultivators e.g. vertical rotor harrows, horizontal rotor harrows). ridging machines, bed formers, stone and clod separation
- b. Planting machinery
 - i. seed drills
 - ii. combination drills
 - iii. direct drill
 - iv. broadcast seeders
 - v. full width seeders
 - vi. air drills
 - vii. precision planters (mechanical and pneumatic)
 - viii. transplanters.
- c. Power unit requirement
 - i. correct attachment
 - ii. traction aids
 - iii. flotation aids
- d. Function
 - i. what the machine does (cut chop smash squash, spread, and sow) and how it does it, (tines discs, coulter types, broadcasters metering units)
 - ii. operational width
- e. Operating principles
 - i. tine angle
 - ii. tine type depth control
 - iii. disc shape
 - iv. size
 - v. function and angle
 - vi. depth control
 - vii. consolidation
 - viii. roll
 - ix. wheel
 - x. position
 - xi. weight transfer
 - xii. ground following.
 - xiii. mouldboard size
 - xiv. shape
 - xv. skimmers
 - xvi. depth control.

Routine service and non-routine maintenance to land-based cultivation and planting machines

- a. Routine service
 - i. pre-season
 - ii. post-season
 - iii. periodic
 - iv. preventative
 - v. pre-storage
 - vi. decontamination
 - vii. pollution control
 - viii. scheduling work
 - ix. manufacturers' recommendations
 - x. service records, manufacturers' warranty
 - xi. procedures

Content:

- b. Non-routine
 - i. repair or replacement due to wear or damage
 - ii. substitution of component type
 - iii. component security
 - iv. machine modifications
- c. Safety
 - i. safe working practices
 - ii. health and safety issues
 - iii. risk assessments
 - iv. PPE
- d. Consequences of non compliance
 - i. component failure
 - ii. unsatisfactory operation
 - iii. reduced output
 - iv. downtime.

Inspection and overhaul procedures on land-based cultivation and planting machines

- a. Machine inspection
 - i. linkage wear
 - ii. framework/chassis cracks or damage
 - iii. component alignment
 - iv. calibration checks
 - v. damage to soil engaging components
 - vi. wear indicators and limits
 - vii. power drive components
 - viii. hydraulic / air supply
- b. Overhaul procedures
 - i. replacement of worn components
 - ii. replacement of bearings and seals
 - iii. wear on seeder mechanisms
 - iv. calibration of delivery mechanisms
 - v. timing of components
 - vi. damage repair / re-fabrication
 - vii. economics
 - viii. component re-alignment
 - ix. maintenance and repair of guards
 - x. lubrication
 - xi. routine service
- c. Safety
 - i. risk assessments
 - ii. safe working practices
 - iii. decontamination of chemicals
 - iv. health and safety issues
 - v. PPE
 - vi. correct disposal of wastes
 - vii. field testing
- d. Condition report
 - i. verbal
 - ii. visual or written report on state of repair of machinery
 - iii. distortion and alignment
 - iv. visual
 - v. measuring.

Content:
Different seedbeds to cater for different crops and planting techniques

- a. Seedbeds
 - i. soil types
 - ii. fineness of seedbed
 - iii. drainage
 - iv. waste burial
 - v. compaction
 - vi. cultivating depth
 - vii. sowing/planting depth and spacing
 - viii. bed forming
 - ix. tram lining working speed
 - x. machine settings
 - xi. manufacturers' instructions
- b. Different crops
 - i. grass seed
 - ii. cereals
 - iii. pulses
 - iv. roots
 - v. bulbs
 - vi. brassica transplants
- c. Planting techniques
 - i. broadcast
 - ii. drilling
 - iii. spacing
 - iv. row width
 - v. beds
 - vi. ridges
 - vii. tram lining
 - viii. headlands
- d. Prepare
 - i. set up as per operator's instruction book
- e. Range of cultivation and planting machines
 - i. powered
 - ii. non powered cultivation equipment
 - iii. drilling and planting machinery
- f. Operate and adjust
 - i. Use the machinery as per the operator's instruction manual, and adjust to gain satisfactory results
- g. Cultivation objectives
 - i. to prepare the soil at the required depth into the required size to meet the needs of the next operation
- h. Planting objectives
 - i. to place the seed at the correct depth, spacing and with correct soil coverage to give germination
- i. Quality of work and work rates
- j. Cultivation
 - i. depth
 - ii. finish
 - iii. clod size
 - iv. speed
 - v. width of machine
- k. Planting
 - i. consistency of seed placement
 - ii. seed spacing
 - iii. seed coverage
 - iv. width of planting
 - v. speed of planting.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none"> • Routine servicing procedures on cultivation and planting equipment
<ul style="list-style-type: none"> • Overhaul procedures on cultivation and planting equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on cultivation and planting equipment
<ul style="list-style-type: none"> • Distortion and alignment checks on cultivation and planting equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LEO328 OPERATE AND SERVICE LAND-BASED VEHICLE TRANSMISSION SYSTEMS

Level: 3

Credit Value: 10

GLH: 60

Mapping: This unit is linked to the Land-based service engineering (NOS).

Rationale: This unit aims to introduce learners to the skills and knowledge in transmission systems used in land based 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

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the layout and function of land based transmission systems	1.1. Illustrate the layouts of a given range of land-based vehicle transmission system 1.2. Explain the function of a range of land-based vehicle transmission systems 1.3. Evaluate the effectiveness of different land-based transmission systems and explain the work situations to which each would be most suited
2. Be able to operate land based vehicle transmission systems	2.1. Carry out land based vehicle transmission systems operations in given situations 2.2. Report advantages and disadvantages of selected land-based transmission system 2.3. Explain the working principles of selected land based transmission systems
3. Be able to maintain land based vehicle transmission systems	3.1. Perform scheduled maintenance operations to land-based vehicle transmission systems in accordance with manufacturers' recommendations 3.2. Carry out a calibration procedure, using manufacturers recommended procedures, on a selected land-based transmission system 3.3. Produce a report outlining the effects of incorrect maintenance and calibrations of land-based transmission systems
4. Be able test and repair land-based transmission systems	4.1. Carry out risk assessments prior to performing repair and test procedures to land based transmission systems 4.2. Carry out repair and test procedures to selected land based transmission systems using manufacturers recommended procedures 4.3. Demonstrate and evaluate the use of specialist tools and test equipment used to carry out repair and test procedures on land based vehicle transmission systems

Content:

Layout and function of land-based transmission systems

- a. Land-based vehicle transmission systems
 - i. two wheel drive
 - ii. four wheel drive
 - iii. hydrostatic drive
 - iv. CVT drive (belt and gear/hydrostatic)
 - v. power take off systems
 - vi. track layer
- b. How the transmission transfers power (gears belts hydrostatics)
- c. The ratio difference between the speed, torque and power of the input into the transmission, compared to the output of the transmission
- d. How the ratio can be and is changed by operator effectiveness.
- e. Efficiency (input power compared to output power)
- f. Economy (cost of purchase, cost of running)
- g. Where each transmission is best suited for each work situation / work carried out
- h. Type of surface (field, road)
- i. Land type (sand, clay, chalk etc)
- j. Speed required
- k. Amount of ground interaction (compaction, grip, traction)

Operate land-based vehicle transmission systems

- a. Systems
 - i. two-wheel drive systems (drive engagement and disengagement, speed/torque selection, speed reduction, traction)
 - ii. four-wheel drive systems (drive engagement and disengagement, speed/torque selection, speed reduction, equal size wheels, unequal size wheels, articulated, traction)
 - iv. power takeoff
 - v. systems (drive engagement and disengagement, methods of selecting driveline speeds)
 - vi. track laying systems (steering, track types, tensioning methods)
 - vii. reasons for system failure e.g. incorrect operator use, faulty components; health and safety; risk assessment
 - viii. transmission clutches: types e.g. dual, multi-plate oil immersed, fluid couplers; clutch operation; uses; advantages and disadvantages
 - ix. gearboxes: types e.g. sliding mesh, constant mesh, synchromesh, semi automatic, powershift; constantly variable transmission; gearbox operation; uses; advantages and disadvantages
 - x. final drives: types e.g. crown wheel and pinion, differential, differential locking, final reduction units, constant velocity joints; uses; advantages and disadvantages

Maintain land-based vehicle transmission systems

- a. Land based vehicle transmission systems
 - i. two wheel drive
 - ii. four wheel drive
 - iii. hydrostatic drive
 - iv. CVT drive (belt and gear/hydrostatic)
 - v. power take off systems
 - vi. track layer
- b. Maintain, service and repair
 - i. reasons for maintenance, servicing and repair
 - ii. use of manufacturers' service manuals
 - iii. methods used to maintain
 - iv. service and repair or replace transmission systems or assemblies as per manufacturers' instructions
 - v. use of vehicle 'on board' or remote ICT equipment to adjust and set optimum performance of complex transmission systems
 - vi. methods used to check the integrity of maintenance
 - vii. service and repair activities
 - viii. health and safety
 - ix. risk assessment
 - x. relevant, current legislation.

Content:

- c. Calibration procedure
- d. Mechanical and electronic setting up of gearbox to ensure smooth efficient working
- e. Report
 - i. written
 - ii. illustrated
 - iii. video.

Test and Repair land-based transmission systems

- a. Repair and test procedures
 - i. inspect
 - ii. remove
 - iii. disassemble
 - iv. repair rebuild, and reinstate transmission units
- b. Land based vehicle transmission systems
 - i. two wheel drive
 - ii. four wheel drive
 - iii. hydrostatic drive
 - iv. CVT drive (belt and gear/hydrostatic)
 - v. power take off systems
 - vi. track layer
- c. Test procedures
 - i. visual
 - ii. audible
 - iii. hydraulic pressure test (solenoids hydrostatics etc.)
 - iv. electronic signal test (solenoids switches etc)
 - v. road test
 - vi. dynamometer test
- d. Methods used to test systems and/or identify faulty components
 - i. sensory
 - ii. electronic
 - iii. pressure/flow
 - iv. use of 'on-board' and remote ICT test equipment
 - v. use of manufacturers' service manuals
- e. Specialist tools and test equipment
 - i. feeler gauges
 - ii. precision measuring equipment
 - iii. spring balance
 - iv. hydraulic pressure/flow gauges
 - v. computer and manufacturers software
 - vi. temperature gauge.

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Operation and routine maintenance Procedures on vehicle transmission systems
<ul style="list-style-type: none"> • Calibration procedures on vehicle transmission systems
<ul style="list-style-type: none"> • Risk assessment prior to performing a repair on vehicle transmission systems
<ul style="list-style-type: none"> • Identifying and rectifying a fault on vehicle transmission systems

Evidence from simulated activities is acceptable for this unit.



UNIT LEO329 - WORKING WITH LAND-BASED CONSTRUCTION PLANT GROUND ENGAGING AND CONSOLIDATION EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based Engineering National Occupational Standards		
Rationale: This unit aims to introduce learners to the skills and knowledge in the maintenance and repair of ground engaging and consolidation 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the function and specification of ground engaging and consolidation construction plant	1.1. Explain the function of construction plant ground engaging machinery 1.2. Explain the specifications of construction plant ground engaging machinery 1.3. Discuss the use of selected ground engaging and consolidation equipment in a given situation
2. Understand the principles of operation of ground engaging and consolidation machinery mechanisms	2.1. Explain principles of operation of ground engaging and consolidation mechanisms of construction plant machinery
3. Be able to carry out maintenance to ground engaging and consolidation equipment	3.1. Carry out risk assessment relevant to scheduled maintenance of ground engaging and consolidation mechanisms of construction plant machinery 3.2. Carry out scheduled maintenance to ground engaging and consolidation mechanisms of construction plant machinery
4. Be able to carry out fault diagnosis and repair on ground engaging and consolidation equipment	4.1. Carry out (using manufacturers recommendations) fault diagnosis and repair on ground engaging and consolidation mechanisms of construction plant machinery 4.2. Describe fault diagnosis and repair carried out

Content:

Function and specification of ground engaging and consolidation construction plant machinery

- a. Ground engaging
- b. Any equipment that is used to dig into or scrape the ground
 - i. diggers 360 degrees
 - ii. 180 degrees
 - iii. trenchers
 - iv. dozers
 - v. bull
 - vi. angle
 - vii. scrapers
 - viii. levellers
- c. Consolidation equipment
 - i. pedestrian controlled
 - ii. ride on
 - iii. any equipment used to consolidate soil and other surfaces
 - iv. compaction tractors
 - v. rollers
 - vi. compaction plates
 - vii. whacker plates
 - viii. vibration rollers
- d. Global positioning system (GPS)
 - i. monitoring
 - ii. working principles,
 - iii. layout of components

Principles of operation of ground engaging and consolidation machinery mechanisms

- a. Explanation
 - i. written
 - ii. verbal
- b. Operation
 - i. the way in which the machinery achieves its goal
 - ii. digging
 - iii. rolling
 - iv. vibration
 - v. applying – pressure
 - vi. force
 - vii. leverage
- c. Mechanisms
 - i. mechanical
 - ii. hydraulic
 - iii. hydrostatic
 - iv. levers
 - v. linkages
 - vi. drive systems
 - vii. engine systems
- d. Tyres, tracks and running gear
 - i. tyres
 - ii. rubber and steel tracks
 - iii. sprockets
 - iv. idlers
 - v. rollers.
- e. Steering systems
 - i. types of steering modes (articulated steering, skid steer, tracked steering)
- f. Transmission systems
 - i. hydrostatic
 - ii. power-shift
 - iii. power-shuttle
 - iv. pre-select
 - v. vibration drive
- g. Hydraulic systems
 - i. open and closed centre
 - ii. digging

Content:

Maintenance to ground engaging and consolidation equipment

- a. Maintenance
 - i. reasons for maintenance and servicing
 - ii. use of manufacturers' service manuals and data
 - iii. pre-use maintenance (complete service, workshop adjustments, security of fixtures and fastenings)
 - iv. in-use maintenance (daily pre-start checks and lubrication, operational/site adjustments)
 - v. post-use maintenance (corrosion protection, replacement of worn parts, storage procedures)
 - vi. strategies (proactive, predictive/ periodic and continuous, replacement)
 - vii. maintenance practices eg on-board condition monitoring, costs
- b. Health and safety
 - i. personal protective equipment (PPE)
 - ii. risk assessments
 - iii. detection of underground services
 - iv. relevant current legislation
 - v. Health and Safety at Work etc Act 1974
 - vi. Control of Substances Hazardous to Health Regulations 2002 (COSHH)
 - vii. Provision and Use of Work Equipment Regulations 1998 (PUWER)
 - viii. Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
 - ix. Environmental management of maintenance activities

Fault diagnosis and repair on ground engaging and consolidation equipment

- a. Faults
 - i. continuous
 - ii. intermittent
 - iii. diagnosis
 - iv. identification of faults using recognised test procedures and equipment, as required by the machine manufacturer
- b. Repair
 - i. short term
 - ii. long term
 - iii. remedial
 - iv. preventative
 - v. carry out procedures which will rectify faults as diagnosed and enable the machine to continue working. i.e. replacement, overhaul, costs, performance (manufacturers' specifications and customer requirements)
 - vi. methods used to test systems and/or identify faulty components e.g. visual, road test, electronic, operator questioning
 - vii. common causes of component and system failure.
 - viii. information gathering and evaluation: sources e.g. question operator, perform diagnostic tests, access service data / workshop manuals, use of fault-finding charts, used oil analysis.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none"> • Risk assessment relevant to routine maintenance on ground engaging and consolidation equipment
<ul style="list-style-type: none"> • Routine maintenance procedures on ground engaging and consolidation equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on ground engaging and consolidation equipment

Evidence from simulated activities is acceptable for this unit.

UNIT LEO330 - UNDERSTANDING AND SERVICING MECHANICAL POWER TRANSMISSION SYSTEMS

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based Engineering National Occupational Standards		
Rationale: This unit aims to introduce learners to mechanisms and methods of transmitting mechanical power in land based vehicle and machine drivelines and how knowledge of this 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.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Know the types of components used to transmit mechanical drives	1.1. Describe the function of a given range of mechanical transmission components 1.2. Identify any faults or wear areas on a range of mechanical transmission components 1.3. Select from the range of components, items that would make up a complete mechanical drive system and describe how the system operates 1.4. From a selected range of mechanical transmission systems, state the possible factors resulting in the manufacturers choosing that system
2. Understand drive system limitations and use	2.1. Explain the limitations of different types of mechanical drive systems 2.2. Compare reasons as to where different systems are suited and unsuitable
3. Be able to service and maintain mechanical drive systems	3.1. Carry out an assessment of possible risks prior to performing service and maintenance tasks to the mechanical drive systems on land-based vehicles and machines 3.2. Following manufacturers guidelines, carry out periodic maintenance and adjustments on mechanical transmission systems 3.3. Produce service tasks to suit the transmissions maintained detailing all critical adjustments and measurement data 3.4. Report on possible implications due to incorrect maintenance and adjustments to each system
4. Be able to overhaul and repair mechanical drive systems that have failed	4.1. Produce a plan of work to outline the procedure to be adopted for the removal of a mechanical transmission unit from a land based vehicle or machine in preparation for overhaul or repair 4.2. Produce a risk assessment prior to performing practical removal, overhaul or repair procedures to a transmission unit 4.3. Carry out a removal, overhaul and repair task on a mechanical land based transmission unit and check the integrity of the unit on completion 4.4. Report the overhaul and repair process, specialised tools, equipment and materials used

Content:

Components used to transmit mechanical drives

- a. Cost, power and torque transmitted
 - b. Driveline protection required
 - c. Operating conditions
 - d. Components available to manufacturer
 - e. Components used in same or other machines in manufactures range
 - f. Gearbox
 - i. transfer box
 - ii. belt and pulley systems
 - iii. chain and gear systems
 - iv. shaft and UJ/CV joints
 - g. Construction, function and working principles of the commonly specified mechanical power transmission systems
 - h. Shafts, e.g. solid, tubular, various cross sections
 - i. Couplings e.g. rigid shaft couplings
 - j. Hooke's type universal joint (UJ)
 - k. constant velocity joint
 - l. Gears e.g. spur gears, bevel gears, worm and wheel, rack and pinion, epicyclic
- Belts e.g. 'Vee', wedge, flat, banded 'vee', poly 'vee', toothed, segmented
- Chains, e.g. roller, roller-less, pintle, hook, cranked link, silent
- Bushings, e.g. split types, solid or sleeve types
- Thrust bearings e.g. ball, roller, needle roller, radial load, thrust load, radial/thrust load
- Springs e.g. open and closed coil, leaf, conical, Bellville, torsion
- r. Seals and gaskets e.g. dynamic seals, radial lip seals, exclusion seals, 'O' rings, face seals, compression packings, static seals for metallic and non metallic gaskets
- Sealants, sealing tapes
- Overrun devices e.g. sprag, inclined plane, centrifugal, roller type
- Torque limiting devices e.g. multi-plate, slip clutch, serrated face clutch, shear bolt
- Fixings hardware, e.g. keys and keyways, taper locks, circlips, roll pins, split pins, lynchpins
- Common uses for different types of mechanical power transmission systems
- Factors affecting choice of mechanical power transmission systems e.g. cost, reliability, strength
- Faults or wear areas
- i. misalignment
 - ii. bearing failure
 - iii. stretched components from heat/overload
 - iv. worn components from lack of lubrication
 - v. worn components from excessive friction
 - vi. broken components from overload/shock loadings
 - vii. breakages/wear due to lack of maintenance

Drive system limitations and use

- a. Types of mechanical drive systems:
 - i. shafts
 - ii. universal joint
 - iii. constant velocity joint
 - iv. gears
 - v. belts
 - vi. chains
 - vii. springs
 - viii. overrun device
 - ix. slip clutch
 - x. shear bolts
 - xi. keys and keyways
 - xii. compression/tension springs
 - xiii. bearings
 - xiv. bushes and friction drive components

Content:

- b. Drive system component limitations
 - i. power
 - ii. torque and speed
 - iii. capacity
 - iv. longevity
 - v. serviceability
 - vi. size of transmission unit
 - vii. component types and causes of failure
 - viii. shafts due to bearing failure
 - ix. couplings due to lack of maintenance
 - x. gears due to contaminated lubrication and bearing failure
 - xi. belts due to lack of tension and overloads
 - xii. chains due to poor maintenance
 - xiii. bushings and bearings due to seal failure
 - xiv. contaminated lubricant and lack of adjustment
 - xv. springs due to overheating
 - xvi. wear and being extended beyond their elastic limit
 - xvii. seals and gaskets due to heat
 - xviii. internal pressures and incorrect fitting
 - xix. overrun devices due to operator engaging power take-off (PTO) at high revolutions per minute (RPM) and allowing machine to idle with PTO engaged
 - xx. slip clutches due to wear
 - xxi. poor maintenance and continual overloading
 - xxii. fixings hardware due to lack of component security or inappropriate application

Service and maintain mechanical drive systems

- a. Risks:
 - i. slips
 - ii. trips
 - iii. falls
 - iv. heavy loads
 - v. falling objects
 - vi. oils and fluids
 - vii. heat
 - viii. high pressure fluids
- b. Mechanical drive systems
 - i. gearbox
 - ii. transfer box
 - iii. belt and pulley systems
 - iv. chain and gear systems
 - v. shaft and UJ/CV joints
- c. Land-based vehicles and machines
 - i. hand held
 - ii. pedestrian
 - iii. self propelled
 - iv. mounted
 - v. trailed machines
- d. Service and maintenance tasks
 - i. types (inspection, cleaning, lubrication, guarding, component security)
 - ii. written procedures covering routine maintenance
 - iii. strip down and/or rebuild
 - iv. critical adjustments and measurement data
 - v. backlash
 - vi. alignment
 - vii. clearance
 - viii. spacing/shimming
 - ix. bearing preload
 - x. tightening torque
 - xi. locking of fasteners
 - xii. gear contact pattern
 - xiii. spacing
 - xiv. tension/compression spring length

Content:

- e. Report
 - i. verbal
 - ii. written or visual
- f. Health and safety issues
 - i. dust
 - ii. heat
 - iii. sharp edges
 - iv. contact with machinery
 - v. stored energy
 - vi. heavy loads
 - vii. relevant and current legislation
 - viii. risk assessment
 - ix. personal protective equipment (PPE)
- g. Sources and types of service information
 - i. sources e.g. manufacturers, libraries
 - ii. types e.g. maintenance schedules
 - iii. operator manuals
 - iv. workshop technical literature
- h. Adjustments to manufacturers' recommendations
 - i. types e.g. belt and chain tension
 - ii. bearing preload and end float
 - iii. spring tension and compression
 - iv. torque limiter settings.

Overhaul and repair of mechanical drive systems that have failed

- a. Mechanical transmission unit
 - i. gearbox
 - ii. transfer box
 - iii. belt and pulley systems
 - iv. chain and gear systems
 - v. shaft and UJ/CV joints
- b. Land-based vehicle
 - i. hand held
 - ii. pedestrian
 - iii. self propelled
 - iv. mounted
 - v. trailed machines
- c. Plan of work
- d. Order of dismantling and refitting of unit
- e. Draining
 - i. storage
 - ii. disposal
 - iii. refilling of fluids
 - iv. tools required
- f. Overhaul or repair
 - i. daily
 - ii. weekly monthly and annual service
 - iii. wearing part replacement
 - iv. breakdown repair.
- g. Risk assessment
 - i. careful examination of what could cause harm to people, so that it can be weighed up whether enough precautions have been taken or should more be done to prevent harm
 - ii. record in a manner so others can see the risks involved easily
 - iii. integrity of the unit
 - iv. fitness of unit for the purpose it was designed for.

Content:

- h. Report:
 - i. concise report
 - ii. easy to see
 - iii. such as a comparison table
- i. Health and safety
 - i. issues e.g. dust, heat, sharp edges
 - ii. contact with machinery
 - iii. stored energy
 - iv. heavy loads
 - v. relevant current legislation
 - vi. risk assessment
 - vii. PPE
- j. Technical information
 - i. types e.g. workshop manuals
 - ii. operator manuals
 - iii. technical specification sheets
- k. Repair and overhaul tasks
 - i. inspection
 - ii. stripping down
 - iii. assessing component failure
 - iv. rebuilding
 - v. adjusting and testing
- l. Repair and overhaul strategies
 - i. strategies e.g. replacement, repair, re-manufacture
 - ii. factors affecting choice of strategy e.g. economic, serviceability of related components, cause of original component failure.

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Risk assessment relevant to routine maintenance of a mechanical transmission unit
<ul style="list-style-type: none"> • Routine maintenance procedures of a mechanical transmission unit
<ul style="list-style-type: none"> • Risk assessment relevant to the removal and overhaul of a mechanical transmission unit
<ul style="list-style-type: none"> • Removal, overhaul and repair of a mechanical transmission unit

Evidence from simulated activities is acceptable for this unit.



UNIT LEO331 - UNDERSTANDING LAND-BASED VEHICLE CHASSIS SYSTEMS

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS		
Rationale: This unit aims to provide learners with an understanding of the function, operation and maintenance requirement of land-based steering and braking systems and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the function, operation and maintenance requirements of land based vehicle steering systems	1.1. Explain the function and operation of land based vehicle steering systems 1.2. Examine land based vehicle steering systems and assess their need for maintenance or repair 1.3. Carry out routine maintenance tasks to steering systems in accordance with manufacturers requirements
2. Understand the function, operation and maintenance requirements of land based vehicle braking systems	2.1. Explain the function and operation of land based vehicle braking systems 2.2. Examine land based vehicle braking systems and assess their need for maintenance or repair 2.3. Carry out routine maintenance tasks to braking systems in accordance with manufacturers requirements
3. Understand the function, operation and maintenance requirements of land based vehicle suspension systems	3.1. Explain the function and operation of land based vehicle suspension systems 3.2. Examine land based vehicle suspension systems and assess their need for maintenance and repair 3.3. Carry out routine maintenance tasks to suspension systems in accordance with manufacturers requirements
4. Be able to carry out serviceability tests and repairs to land based vehicle steering, braking and suspension systems	4.1. Outline the procedure to be adopted for the removal of chassis system units from a land based vehicle in preparation for overhaul or repair 4.2. Assess risks prior to performing practical removal, overhaul or repair procedures to chassis system units 4.3. Carry out a removal, overhaul and repair task on land based vehicle chassis system units and check the integrity of the unit on completion

Content:

Function, Operation and Maintenance requirements of land-based vehicle steering systems

- a. Steering systems
 - i. manual
 - ii. power assisted
 - iii. hydrostatic
 - iv. front
 - v. rear
 - vi. 2/4 wheels steer
 - vii. centre pivot
 - viii. skid steer
 - ix. crab steering
 - x. zero turn
- b. Advantages and disadvantages
 - i. uses
 - ii. user friendliness
 - iii. costs
- c. Components
 - i. types eg steering box types, rack and pinion, linkage, steering metering valve
- d. Steering principles
 - i. Ackerman layout
 - ii. toe in/out
 - iii. castor
 - iv. camber and king pin inclination
 - v. other relevant types.
- e. Assess their need for maintenance or repair
 - i. Routine maintenance
 - ii. planned wearing component replacement
 - iii. emergency on site repair
- f. Appropriate health and safety; personal protective equipment (PPE)
- g. Manufacturer's requirements
 - i. manufacturers' workshop manuals
 - ii. operators books
 - iii. service schedule
 - iv. legislation checking for play
 - v. alignment
 - vi. force required to turn.

Function, Operation and Maintenance requirements of land-based vehicle braking systems

- a. Land-based vehicle braking systems
 - i. disc
 - ii. drum
 - iii. band brakes
 - iv. hydraulic
 - v. mechanical
 - vi. electrical
 - vii. pneumatic
 - viii. wet braking
 - ix. hydro pneumatic operation
 - x. single
 - xi. split
 - xii. load compensating brake systems
 - xiii. over-run brakes
- b. Components
 - i. types eg leading and trailing shoe arrangements
 - ii. single and multi-disc arrangements
 - iii. wheel cylinders
 - iv. master cylinders
 - v. callipers
 - vi. adjusters
 - vii. servo
 - viii. ABS
 - ix. park brake mechanisms

Content:

- a. Assess their need for maintenance or repair
 - i. routine maintenance
 - ii. planned wearing component replacement
 - iii. emergency on site repair
 - iv. maintenance requirements: e.g. balance, wear, replace, refit, skim, measure, run out.
- b. Manufacturers' requirements
 - i. manufacturers' workshop manuals
 - ii. operators books
 - iii. service schedule
 - iv. legislation

Function, Operation and Maintenance requirements of land-based vehicle suspension systems

- a. Land-based vehicle suspension systems
 - i. Polymer
 - ii. beam axle suspension
 - iii. coil/leaf springs
 - iv. hydraulic
 - v. pneumatic
 - vi. torsion bar suspension
 - vii. beam axle
 - viii. front / rear / independent suspension
- b. Advantages and disadvantages
 - i. uses
 - ii. user friendliness
 - iii. costs
 - iv. tyre construction and design
 - v. treads and markings.
- c. Assess their need for maintenance and repair
 - i. routine maintenance
 - ii. planned wearing component replacement
 - iii. emergency on site repair
 - iv. assessment delivered by report (verbal or written).
- d. Manufacturers' requirements
 - i. manufacturers' workshop manuals
 - ii. operators books
 - iii. service schedule
 - iv. legislation.
- e. Checks on effectiveness
 - i. sag (visual / measurement)
 - ii. appropriate Health and safety
 - iii. PPE.

Content:

Serviceability Tests and Repairs to land-based vehicle steering, braking and suspension systems.

- a. Chassis system units
 - i. brakes
 - ii. suspension
 - iii. steering units.
- b. Assess risks
 - i. Assessing and recording risks prior to work, to highlight risks of injury/damage to learner, tutor, third parties, and machinery, actions required to minimise risks
 - ii. Correctly and to manufacturers' specifications remove relevant chassis units, check, overhauled, repair, correctly replace, repairs.
- c. Removal, overhaul and repair
 - i. steering
 - ii. suspension and braking assemblies
 - iii. dismantling and rebuilding of steering
 - iv. suspension and braking system assemblies following manufacturers' service manual procedures
 - v. visual inspection
 - vi. adjustments to steering
 - vii. suspension and braking assemblies as recommended by manufacturers' service manuals
 - viii. health and safety.
- d. Test
 - i. steering
 - ii. suspension and braking assemblies
 - iii. recognition of faulty components in steering
 - iv. suspension and braking assemblies
 - v. visual inspection
 - vi. testing procedures as recommended by manufacturers' service
 - vii. manuals to determine successful repairs to steering
 - viii. suspension and braking assemblies
 - ix. health and safety
 - x. PPE.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none"> • Risk assessment relevant to the removal, overhaul and repair to a chassis system
<ul style="list-style-type: none"> • Removal, overhaul and repair to each of the chassis systems (steering, braking and suspension)

Evidence from simulated activities is acceptable for this unit.



UNIT LEO333 - UNDERSTANDING AND WORKING WITH GROUND CARE EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS.		
Rationale: This unit aims to introduce learners to the skills and understanding in ground care 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.		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the purpose and operation of ground care equipment	1.1. Explain the principles of operation of given grass surface establishment and maintenance equipment 1.2. Explain the principles of operation of given grass cutting equipment
2. Be able to safely operate ground care equipment	2.1. Safely operate given grass surface establishment and maintenance equipment 2.2. Safely operate given grass cutting equipment
3. Be able to maintain and repair equipment to establish and maintain grass surfaces	3.1. Safely carry out (using manufacturers' service data) routine maintenance of equipment to given objectives 3.2. Safely repair equipment to given objectives
4. Be able to maintain and repair equipment used to cut grass	4.1. Safely carry out (using manufacturers' service data) routine maintenance of equipment used to cut grass 4.2. Safely repair equipment used to establish and maintain grass surfaces

<p>Content:</p> <p>Purpose and operation of ground care equipment</p> <p>a. Principles of operation</p> <ul style="list-style-type: none"> i. mowers ii. centrifugal (strimmer, cord, flail, chain) iii. rotary iv. cylinder v. pedestrian controlled vi. ride-on vii. tractor mounted viii. trailed <p>b. Grass maintenance equipment</p> <ul style="list-style-type: none"> i. spikers ii. slitters iii. aerators iv. turf drainers v. brushes vi. drag mats vii. top dressers viii. overseeders ix. white line markers
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Content:

- c. Establishment and maintenance equipment
 - i. rotary cultivation equipment
 - ii. levelling equipment
 - iii. drainage and aeration equipment
 - iv. sub-soil equipment
 - v. stone pickers
 - vi. scarifiers
 - vii. mowers
 - viii. groomers
 - ix. rotavators
 - x. fertiliser distributors/spreaders
 - xi. sprayers
 - xii. seeding equipment
 - xiii. irrigation equipment
 - xiv. trimmers
 - xv. mowing machinery (fine turf, professional and domestic) ploughs
 - xvi. subsoilers
 - xvii. tined cultivators
 - xviii. non-power driven
 - xix. power driven cultivators
 - xx. pedestrian and tractor powered
 - xxi. grass seed drills

Safely operate ground care equipment

- a. Operation
 - i. pre-start procedure
 - ii. safe operation
 - iii. operator adjustments
 - iv. lubrication
 - v. post-use cleaning and storage
 - vi. effects of incorrectly operated machinery (short and long-term damage to turf or grass, commercial impacts)

Maintain and repair equipment to establish and maintain grass surfaces

- a. Routine maintenance
 - i. daily
 - ii. periodic and operational maintenance
- b. Equipment
 - i. rotary cultivation equipment
 - ii. levelling equipment
 - iii. drainage and aeration equipment
 - iv. sub-soil equipment
 - v. stone pickers
 - vi. scarifiers
 - vii. groomers
 - viii. rotavators
 - ix. fertiliser distributors/ spreaders
 - x. sprayers
 - xi. seeding equipment
 - xii. irrigation equipment.
- c. Grass surface establishment machinery
 - i. tine replacement
 - ii. power units
 - iii. transmission units
 - iv. safety guarding
 - v. lubrication
 - vi. calibration
 - vii. manufacturers' recommended testing procedures
 - viii. faults and component failure eg poor maintenance
 - ix. operator error
 - x. component fatigue
 - xi. excessive use
 - xii. ground conditions

Content:

- d. Grass maintenance machinery
 - i. tine replacement
 - ii. power units
 - iii. transmission units
 - iv. safety guarding
 - v. lubrication
 - vi. calibration
 - vii. manufacturers' recommended testing procedures
 - viii. faults and component failure eg poor maintenance
 - ix. operator error
 - x. component fatigue
 - xi. excessive use
 - xii. ground conditions.

Maintain and repair equipment used to cut grass

- a. Routine maintenance
 - i. daily
 - ii. periodic and operational maintenance
- b. Equipment used to cut grass
 - i. trimmers
 - ii. mowers (fine turf, cylinder, rotary)
 - iii. centrifugal cutting systems (flails, chains and cords)
- c. Equipment used to establish and maintain grass surfaces
 - i. rotary cultivation equipment
 - ii. levelling equipment
 - iii. drainage and aeration equipment
 - iv. sub-soil equipment
 - v. stone pickers
 - vi. scarifiers
 - vii. mowers
 - viii. groomers
 - ix. rotavators
 - x. fertiliser distributors/ spreaders
 - xi. sprayers
 - xii. seeding equipment
 - xiii. irrigation equipment
 - xiv. trimmers
 - xv. mowing machinery (fine turf, professional and domestic) power units
 - xvi. transmission units
 - xvii. cutting mechanisms
 - xviii. safety guarding
 - xix. manufacturers' recommended testing procedures
 - xx. faults and component failure e.g. poor maintenance
 - xxi. operator error
 - xxii. component fatigue
 - xxiii. excessive use
 - xxiv. ground conditions
- d. Professional grass cutting equipment
 - i. power units
 - ii. transmission units
 - iii. cutting mechanisms
 - iv. safety guarding
 - v. on highway requirements
 - vi. manufacturers' recommended testing procedures
 - vii. faulty components
 - viii. maintenance
 - ix. repair

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Operate safely ground care equipment
<ul style="list-style-type: none"> • Routine maintenance and repair of surface establishment and maintenance equipment
<ul style="list-style-type: none"> • Routine maintenance and repair of grass cutting equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LEO334 - UNDERTAKING 4WD VEHICLE MAINTENANCE, OPERATION AND RECOVERY

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS.		
Rationale: 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand common features and specifications of a 4WD vehicle	1.1. Explain the features and specifications of a 4WD vehicle 1.2. Discuss situations where these features would be used
2. Be able to carry out routine maintenance of a 4WD vehicle	2.1. Assess the condition of a 4WD vehicle 2.2. Carry out routine maintenance of a 4WD vehicle according to manufacturer's instructions
3. Be able to operate a 4WD vehicle in varying land conditions	3.1. Review the extent to which the features of a 4WD vehicle enable it to operate in off-road situations 3.2. Safely operate a 4WD vehicle in on and off-road situations
4. Be able to recover a 4WD vehicle	4.1. Review options for recovering 4WD vehicles from typical situations 4.2. Safely recover a 4WD vehicle

<p>Content:</p> <p>Common features and specifications of a 4WD vehicle</p> <ul style="list-style-type: none"> a. Features and specifications of a 4WD vehicle b. Engine:- fuel and size c. Gearbox:- Automatic/manual, number of speeds d. Transfer box: 2/4 wheel drive, central differential e. Differential:- open, locking, plate type limited slip differential (LSD), Helical LSD, ramp type LSD. Axles/suspension:- Leaf springs <ul style="list-style-type: none"> i. coils springs ii. air springs iii. independent axles iv. beam axles v. articulation f. Tyres:- size and tread pattern, pressure g. Electronic driving aids:- traction control, incline decent assistance h. Dimensions:- ramp over angle, approach angle, departure angle, safety devices i. Situations:- terrain, soil type, inclination, soil moisture, ruts, wet spots. j. Specifications:- engine, suspension (parabolic springing, air suspension), steering, brakes, off-road capability, dimensions, weight, performance, fuel economy k. Traction aids (viscous couplings, electronic traction control, multi-plate transfer (MPT), hill descent control (HDC), pneumatic-locking differentials); attachments; operator facilities.
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Content:

Routine maintenance of a 4WD vehicle

- a. Condition:- Readiness of the vehicle to be used with special attention to mechanical/electrical units unique to the 4WD system
- b. Routine maintenance
 - i. daily
 - ii. weekly
 - iii. monthly and annual maintenance
 - iv. plus extra checks needed after off road use
 - v. cleaning
 - vi. manufacturers' recommendations and service schedules
 - vii. pre-start checks
 - viii. tyres (selection, care, pressures)
 - ix. lubrication
 - x. fuel
 - xi. battery
 - xii. security and maintenance of fixtures and fittings e.g. winches, seats, safety belts, common causes of component failure, maintenance and component failure prevention strategies
 - xiii. health and safety
 - xiv. risk assessment
 - xv. relevant current legislation and codes of practice.

Operate a 4WD vehicle in varying land conditions

- a. Features of a 4WD vehicle
- b. Engine:- fuel and size
- c. Gearbox:- Automatic/manual, number of speeds
- d. Transfer box:- 2/4 wheel drive, central differential
- e. Differential:- open, locking, plate type LSD, Helical LSD, ramp type LSD.
- f. Axles/suspension:- Leaf springs
 - i. coils springs
 - ii. air springs
 - iii. independent axles
 - iv. beam axles
 - v. articulation
- g. Tyres:- size and tread pattern, pressure
- h. Electronic driving aids:- traction control, incline decent assistance
- i. Dimensions:- ramp over angle, approach angle, departure angle, safety devices
- j. Off-road situations:- Terrain, slopes, water (standing and running)
- k. Operation:- Drive to conditions, paying attention to vehicle sympathy, operator safety and comfort and environmental conditions pre and post operation, with respect for others and the environment.
- l. Instrumentation and controls: position and use of, warning lights, isolators, steering wheel, controls, mirrors, vehicle handbooks
- m. Surveying the ground: features and conditions e.g. softness, wetness, soil type, rutted, rough, angle of slope
- n. Maintaining traction: technique e.g. use of gears, use of brakes, engine revs, tyre specification and pressures, traction aids
- o. Ground clearance: approach angle; departure angle; ramp break over angle; articulation
- p. Gears: selection and use e.g. auto/manual, centre differential lock, range selection, 2WD/4WD, starting in gear.
- q. Gradients: gear selection; reversing; starting and stopping; ascending and descending
- r. Side slopes: angle of slope; gear selection; obstacles; load distribution
- s. Wading/fording: preparation e.g. snorkels, wading plugs, radiator protection, identification of water depth and obstacles; effects of bow waves, gear selection
- t. Environmental protection: methods e.g. elimination of wheel spin, country code, respect for nature, litter, rights of way, pollution prevention; relevant current legislation; respect for others and the environment

Content:

Recover a 4WD vehicle

- a. Typical situations
 - i. stuck in mud
 - ii. cross rutted
 - iii. water ingress in engine
 - iv. loss of traction
 - v. grounding out and cross axle
- b. Recovery Techniques
 - i. drive out
 - ii. dig out
 - iii. jack out
 - iv. pull out with rope and another vehicle
 - v. winch out
 - vi. safety
 - vii. signalling
 - viii. environmental protection
- c. Equipment and its use
 - i. winches (mechanical, electric, hydraulic, capstan)
 - ii. simple traction aids
 - iii. high-lift jacks
 - iv. kinetic recovery straps
 - v. anchors
 - vi. anchor points
 - vii. tow ropes/straps/chains
 - viii. shackles
 - ix. protective strops
 - x. snatch blocks
 - xi. shovels and ladders
 - xii. health and safety
 - xiii. risk assessment
 - xiv. personal protective equipment (PPE)
- d. Winch selection
 - i. maximum line pull
 - ii. stall rating
 - iii. duty cycle
 - iv. vehicle electrical system preparation
 - v. mounting points.

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Operate 4WD vehicle in varying land conditions
<ul style="list-style-type: none"> • Routine maintenance to 4WD vehicle
<ul style="list-style-type: none"> • Recover 4WD vehicle from typical situations

Evidence from simulated activities is acceptable for this unit.



UNIT LEO335 - UNDERSTAND AND WORK WITH LAND-BASED REPAIR PROCESSES AND MATERIALS TECHNOLOGY

Level: 3	Credit Value: 10	GLH: 60
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Mapping: This unit is linked to the land-based service engineering NOS.

Rationale: This unit aims to introduce learners to material and joining skills and knowledge in 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

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Know the structure and properties of materials	1.1. Describe the structure and properties of metals used in land based technology 1.2. Describe the structure and properties of non-metal materials used in land-based technology
2. Understand mechanical, non thermal and thermal joining processes	2.1. Explain selected mechanical, non thermal and thermal joining processes for metals 2.2. Explain selected mechanical, non thermal and thermal joining processes for non-metal materials used in land based technology
3. Be able to prepare materials for mechanical, non thermal and thermal joining processes	3.1. Safely prepare selected metal engineering materials for joining 3.2. Safely prepare selected non-metal engineering materials for joining
4. Be able to use mechanical, non thermal and thermal joining processes	4.1. Safely join metal engineering materials to meet given objectives 4.2. Safely join non-metal engineering materials to meet given objectives

Content:

Structure and properties of materials

- a. Structure
 - i. hardness
 - ii. softness
 - iii. strength (tensile, compressive, shear, torsional)
- b. Properties
 - i. brittleness
 - ii. toughness
 - iii. plasticity
 - iv. malleability
 - v. elasticity
 - vi. conductivity (electrical and thermal)
 - vii. ductility
 - viii. expansion
 - ix. stability
 - x. yield point
 - xi. chemical stability (corrosion and oxidation)
- c. Metals
 - i. ferrous
 - ii. non ferrous
 - iii. alloy metals
- d. Non metal
 - i. thermo-set plastics
 - ii. thermo setting plastics
- e. Methods and effects of heat treatment on ferrous metals
 - i. annealing
 - ii. normalising
 - iii. hardening
 - iv. case hardening
 - v. tempering
- f. Identification methods for ferrous, non-ferrous, thermo set and thermosetting plastic materials:- e.g. filing, sawing; spark test, knick, break, 'scrape', heat.

Mechanical, non thermal and thermal joining processes

- a. Mechanical
 - i. nuts
 - ii. bolts
 - iii. set screws
 - iv. studs
 - v. thread forms 'eg' Unified National Fine, Unified National Course, Metric Fine, Metric Course, British Association
 - vi. rivets
 - vii. keys
 - viii. pins
 - ix. captive fasteners
 - x. locking devices.
- b. Non thermal
 - i. adhesives
 - ii. fibreglass
 - iii. crimping
 - iv. soldering
- c. Thermal joining

Content:

- d. Brazing
 - i. oxy- acetylene
 - ii. manual metal arc
 - iii. metal inert gas
 - iv. methods
 - v. uses
 - vi. equipment
 - vii. materials
 - viii. costs
 - ix. health and safety
 - x. risk assessment
 - xi. PPE
 - xii. welding standards
 - xiii. safe working practices
 - xiv. metals:- ferrous, non ferrous, alloy metals
 - xv. non-metals:- thermo set plastics, thermo setting plastics.

Prepare materials for mechanical, non thermal and thermal joining processes

- a. Prepare
 - i. thermal cutting (plasma, oxy-acetylene, oxy-propane)
 - ii. sawing
 - iii. shearing
 - iv. grinding
 - v. filing
 - vi. drilling
 - vii. abrasives thread cutting
 - viii. marking out
 - ix. measuring
 - x. clamping
 - xi. tacking (positioning of materials to be joined by thermal, non-thermal or mechanical processes)
 - xii. metal:- ferrous, non ferrous, alloy metals
- b. Safety
 - i. risk assessment
 - ii. safe practices
 - iii. personal protective equipment
 - iv. fume extraction
 - v. dusts
 - vi. fumes
 - vii. radiation
 - viii. swarf
 - ix. sparks
 - x. noise
 - xi. spatter
 - xii. hot metals (effects on worker and third parties)
 - xiii. gas safety
 - xiv. codes of practice
 - xv. industry codes,
 - xvi. relevant legislation
- c. Joining
 - i. thermal
 - ii. non-thermal
 - iii. mechanical.
 - iv. non-metal
 - v. thermo set plastics
 - vi. thermo setting plastics.

Content:

Use mechanical, non thermal and thermal joining processes

- a. Given objectives
 - i. drawings
 - ii. tolerances
 - iii. repair
 - iv. long term
 - v. short term
 - vi. fit for purpose
- b. Metal:- ferrous, non ferrous, alloy metals
- c. Non-metal:- thermo set plastics, thermo setting plastics
- d. Mechanical, non-thermal and thermal processes
 - i. common types and durability of joint
 - ii. advantages
 - iii. disadvantages
 - iv. availability of resources
 - v. mechanical processes e.g. nuts, bolts, studs, set screws, thread forms, locking devices, rivets, keys, pins, circlips, captive fasteners
 - vi. non-thermal:- e.g. adhesives, fibreglass, crimping, soldering, brazing
 - vii. thermal:- e.g. oxy-acetylene, manual metal arc, metal inert gas
- e. Weld test procedures
- f. Health and safety
 - i. risk assessment
 - ii. safe working practices
 - iii. PPE
 - iv. environmental risk assessment
 - v. fumes
 - vi. dusts
 - vii. heat
 - viii. light and heat radiation
 - ix. sparks and spatter
 - x. relevant current legislation and codes of practice.

Evidence Requirements

1. You must produce evidence of carrying out both types of joining process listed below to metallic and non metallic materials
<ul style="list-style-type: none"> • Non thermal
<ul style="list-style-type: none"> • Mechanical
2. You must produce evidence of carrying out two of the four joining disciplines listed below
<ul style="list-style-type: none"> • Brazing
<ul style="list-style-type: none"> • Oxy-acetylene
<ul style="list-style-type: none"> • MMA
<ul style="list-style-type: none"> • MIG/MAG

Evidence from simulated activities is acceptable for this unit.

**UNIT LEO336 - UNDERSTANDING LAND-BASED MACHINERY MANAGEMENT****Level: 3****Credit Value: 10****GLH: 60****Mapping:** This unit is linked to the Land-based service engineering NOS.**Rationale:** This unit aims to introduce learners to the skills and knowledge in machinery selection, sourcing, legislation and finance 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

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand selection criteria for machinery	1.1. Explain the factors that should be considered when selecting appropriate land-based machinery 1.2. Determine selection criteria for land-based machinery
2. Understand acquisition of land-based machinery	2.1. Examine sources for obtaining machinery 2.2. Discuss financial options for obtaining machinery
3. Understand measures for determining the efficiency and financial costs of machinery operation	3.1. Explain methods of measuring efficiency of machine operation 3.2. Calculate costs associated with machine operation
4. Know regulation that affects the ownership and operation of land-based machinery	4.1. Explain how relevant codes of practice and legal requirements influence machinery ownership and operation 4.2. State the legal requirements for taking machinery on the highway

Content:**Selection criteria for machinery**

- a. Explain:- Written or Verbal
- b. Factors:- Operations required
 - i. performance required
 - ii. local dealerships
 - iii. sales staff
 - iv. lead time
 - v. spares supply
 - vi. market share
 - vii. user reports
 - viii. peer reports
 - ix. personal recommendation
 - x. technical reports
 - xi. press reports
 - xii. personal preference
 - xiii. brand loyalty

Content:

- c. Land-based machinery
 - i. tractors
 - ii. combine harvester
 - iii. sugar beet and other root harvesters
 - iv. sprayers
 - v. fertilizer spreaders
 - vi. tele-handlers
 - vii. forage harvesters
 - viii. mowers
 - ix. rakes/tedders
 - x. ploughs
 - xi. cultivation equipment
 - xii. trailers
 - xiii. feeders
 - xiv. wagons
 - xv. muck spreaders
 - xvi. irrigators
 - xvii. seed drills
 - xviii. balers
 - xix. timber harvesters
 - xx. forwarders
 - xxi. ground maintenance equipment
- d. Criteria
 - i. use level
 - ii. hours per year
 - iii. all year or seasonal
 - iv. operating costs
 - v. replacement costs
 - vi. work rates required
 - vii. work rates achievable
 - viii. resale value
 - ix. legal restrictions
 - x. training required
 - xi. operator competence
 - xii. crops
 - xiii. ground/soil conditions
 - xiv. primary use
 - xv. additional uses
 - xvi. life span
 - xvii. depreciation
 - xviii. personal preference
 - xix. environmental impact
 - xx. after-sales service e.g. warranty period and conditions
 - xxi. availability of spare parts
 - xxii. dealer support
 - xxiii. operator training
 - xxiv. relevant and current legislation.

Content:

Acquisition of land-based machinery

- a. Sources
 - i. farmer co-operative
 - ii. machinery rings
 - iii. hire
 - iv. lease
 - v. contract hire
 - vi. seasonal hire
 - vii. local dealer
 - viii. national supplier
 - ix. specialist supplier
 - x. manufacturer
- b. Options
 - i. short term hire
 - ii. long term hire
 - iii. purchase
 - iv. lease
 - v. sources of finance:- e.g. personal capital, bank loan, purchasing options (direct purchase, bank loan, hire purchase, contract hire, leasing)
 - vi. list price and availability of discounts from suppliers and manufacturers
 - vii. second-hand machinery purchase options e.g. direct from vendor, auctions
- c. Replacement
 - i. resale value
 - ii. trade-in value
 - iii. varying contract types.

Measures for determining the efficiency and financial costs of machinery operation

- a. Measuring efficiency
 - i. work rates (spot rate, effective rate)
 - ii. fuel consumption
 - iii. application rates
 - iv. manufacturer's data
 - v. speed of operation
 - vi. output per hour
 - vii. output per litre of fuel
 - viii. hectares per hour
 - ix. hectares per day
 - x. calibration
- b. Calculate costs
 - i. use accepted formulae and standards as appropriate
 - ii. replacement costs
 - iii. depreciation (straight line, reducing balance; importance of and relationship to business financial statements)
 - iv. spares costs
 - v. wearing parts
 - vi. fuel costs
 - vii. running costs
 - viii. purchase costs
 - ix. licence requirements
 - x. purchase price
 - xi. fixed and variable costs (tax, insurance, fuel, maintenance, labour)
 - xii. servicing
 - xiii. fuel
 - xiv. repairs
 - xv. record keeping
 - xvi. operator training
 - xvii. methods used to reduce costs.

Content:

Regulation that affects the ownership and operation of land-based machinery

- a. Codes of Practice
- b. Legislative
- c. Provision and Use of Work Equipment Regulations
- d. Lifting Operations and Lifting
- e. Equipment Regulations
- f. Noise at Work Regulations
- g. Whole Body Vibration Regulations
- h. Control of Substances Hazardous to Health regulations
- i. Voluntary
- j. Industry Led, (i.e. Pesticides Code of practice, BAGMA code of practice for Tractor maintenance)
- k. Crop Assurance Schemes
- l. Customer led
- m. Health and Safety Executive (HSE)
- n. National Sprayer Testing Scheme (NSTS)
- o. Legal requirements
- p. Construction and Use Regulations
- q. Highways Act
- r. Braking Requirements
- s. Driver licensing
- t. Vehicle Excise Duty
- u. Operators License
- v. Width, Weight, Length restrictions
- w. Use of rebated Fuel
- x. Agricultural Restrictions
- y. Definitions of Agricultural Tractors and other Agricultural machines and equipment
- z. Marking of Extremities
- aa. Escort Vehicle
- bb. Police Notification
- cc. Operator awareness and continuing professional development (CPD)
- dd. Highway:- Any part of a road that is open to the public, single carriageway, dual carriageway, rural areas, built up areas.

No Evidence Requirements



UNIT LEO337 - WORKING WITH LAND-BASED TOOL HIRE MACHINERY AND MECHANISMS

Level: 3	Credit Value: 10	GLH: 60
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Mapping: This unit is linked to the Land-based service engineering NOS.

Rationale: This unit aims to introduce learners to the skills and understanding in tool and plant hire machinery and 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.

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the function and operation of tool and plant hire machinery and equipment	1.1. Explain the function and operation of small hand-held hire equipment 1.2. Explain the function and operation of non hand-held hire machinery and equipment
2. Understand maintenance requirements and schedules for tool and plant hire machinery and equipment	2.1. Explain the maintenance requirements of small hand-held hire equipment 2.2. Explain the maintenance requirements of non hand-held hire machinery and equipment
3. Be able to perform the handover of land-based machinery and equipment	3.1. Carry out pre-delivery inspection of machinery and equipment 3.2. Explain to user safe operation and maintenance of small hand-held hire equipment 3.3. Explain to user safe operation and maintenance of non hand-held machinery and equipment
4. Be able to inspect, maintain and service tool and plant hire machinery and equipment	4.1. Safely inspect, maintain and service selected small hand-held hire equipment using manufacturers' service data 4.2. Safely inspect, maintain and service selected non hand-held hire machinery and equipment using manufacturers' service data
5. Be able to carry out fault diagnosis and test procedures on tool and plant hire machinery and equipment	5.1. Safely carry out fault finding and testing procedures on selected small hand-held equipment 5.2. Safely carry out fault finding and testing procedures on selected non-hand-held machinery and equipment 5.3. Report on status of machinery and equipment as a result of tests carried out

Content:

Function and operation of tool and plant hire machinery and equipment

- a. Small hand – held hire equipment
 - i. electrically powered
 - ii. engine powered
 - iii. drills
 - iv. dryers
 - v. grinders
 - vi. disc cutters
 - vii. cut off saws
 - viii. floor saws
 - ix. sanders
 - x. polishers
 - xi. planers
 - xii. chainsaws
 - xiii. brush cutters
 - xiv. circular saws
 - xv. jig saws
 - xvi. thread cutting equipment
 - xvii. sprayers
 - xviii. pressure washers
 - xix. submersible pumps
- b. Non hand-held machinery
 - i. non-ride on
 - ii. ride on
 - iii. electrical powered
 - iv. engine powered
 - v. cement mixers
 - vi. wacker plates
 - vii. rollers
 - viii. compacters
 - ix. shredders
 - x. chippers
 - xi. scabblers
 - xii. grinders
 - xiii. mowers
 - xiv. powered barrows
 - xv. compressors
 - xvi. breakers(pneumatic / hydraulic)
 - xvii. power heads
 - xviii. mini diggers
 - xix. fork lift trucks
- c. Non powered
 - i. ladders
 - ii. steps
 - iii. scaffolding
 - iv. tower scaffolds
 - v. chains
 - vi. straps
 - vii. barrows
 - viii. pallet trucks
- d. Tracks
 - i. running gear
 - ii. rollers
 - iii. steel tracks
 - iv. rubber tracks
 - v. sprockets and idlers
 - vi. undercarriages.

Content:

- e. Ground engaging equipment
 - i. blades
 - ii. buckets
 - iii. breakers
 - iv. augers
 - v. common causes of component failure
- f. Ground consolidation equipment
 - i. vibratory rollers
 - ii. vibration plates
 - iii. trench rollers
 - iv. common causes of component failure

Maintenance requirements and schedules for tool and plant hire machinery and equipment

- a. Maintenance
 - i. routine
 - ii. non routine
 - iii. daily
 - iv. periodic
- b. Small hand-held hire equipment
 - i. hand operation
 - ii. electrical powered
 - iii. engine powered
 - iv. drills
 - v. grinders
 - vi. disc cutters
 - vii. cut off saws
 - viii. sanders
 - ix. polishers
 - x. planers
 - xi. chainsaws
 - xii. brush cutters
 - xiii. circular saws
 - xiv. jig saws
 - xv. thread cutting equipment
 - xvi. sprayers
- c. Non hand-held machinery
 - i. non-ride on
 - ii. ride on
 - iii. electrical powered
 - iv. engine covered
 - v. cement mixers
 - vi. wacker plates
 - vii. rollers
 - viii. compacters
 - ix. shredders
 - x. chippers
 - xi. grinders
 - xii. mowers
 - xiii. powered barrows
 - xiv. compressors
 - xv. fork lift trucks
- d. Non powered
 - i. ladders
 - ii. steps
 - iii. scaffolding
 - iv. tower scaffolds
 - v. chains
 - vi. straps
 - vii. barrows
 - viii. pallet trucks

Content:

- e. Maintenance
 - i. reasons for maintenance and servicing
 - ii. use of manufacturers' service manuals and data
 - iii. pre-use maintenance (complete service, workshop adjustments, security of fixtures and fastenings)
 - iv. in-use maintenance (daily pre-start checks and lubrication, operational/site adjustments)
 - v. post-use maintenance (corrosion protection, replacement of worn parts, storage procedures)
 - vi. strategies (proactive, predictive/ periodic and continuous, replacement)
 - vii. maintenance practices e.g. on-board condition monitoring, costs

Handover of land-based machinery and equipment

- a. Pre delivery inspection
- b. Inspection carried out to ensure suitability for use
- c. New equipment
- d. Used equipment
- e. Safe operation;- As required by legislation
- f. Manufacturers instructions,
- g. RCD
- h. Maintenance
 - i. daily
 - ii. periodic
 - iii. fuelling
 - iv. inspection
 - v. sharpening
 - vi. cleaning
 - vii. changing components (discs, blades) lubrication
 - viii. tyre pressures cooling
- i. Equipment - Hand operated
 - i. electrical powered
 - ii. engine powered
 - iii. drills
 - iv. grinders
 - v. disc cutters
 - vi. cut off saws
 - vii. sanders
 - viii. polishers
 - ix. planers
 - x. chainsaws
 - xi. brush cutters
 - xii. circular saws
 - xiii. jig saws
 - xiv. thread cutting equipment
 - xv. sprayers
- j. Non hand-held machinery
 - i. non-ride on
 - ii. ride on
 - iii. electrical powered
 - iv. engine powered
 - v. cement mixers
 - vi. wacker plates
 - vii. rollers
 - viii. compacters
 - ix. shredders
 - x. chippers
 - xi. grinders
 - xii. mowers
 - xiii. powered barrows
 - xiv. compressors
 - xv. fork lift trucks

Content:

- k. Non powered
 - i. ladders
 - ii. steps
 - iii. scaffolding
 - iv. tower scaffolds
 - v. chains
 - vi. straps
 - vii. barrows
 - viii. pallet trucks
- l. Handover procedures
 - i. handover procedures (including any statutory requirements) for a specific item
 - ii. procedures for familiarising the hirer with the specific machine's operational controls
 - iii. procedures for operating the machinery/equipment safely and correctly
 - iv. pre-delivery inspection (PDI)
 - v. daily/weekly and safety checks
 - vi. emergency shutdown and isolation procedures
 - vii. specialist PPE
 - viii. record and documentation systems and procedures
 - ix. the necessary documentation for the specific items of equipment
 - x. safety literature
 - xi. operating instructions
 - xii. acceptance receipts
 - xiii. records of test certificates
 - xiv. risk assessments
 - xv. method statements

Be able to inspect, maintain and service tool and plant hire machinery and equipment

- a. Safely
 - i. as required by manufacturers guidance
 - ii. risk assessment
 - iii. company policy
 - iv. legislation
- b. Inspection
 - i. visual
 - ii. auditory
 - iii. touch
 - iv. smell
 - v. test run
 - vi. competent person
- c. Maintain
 - i. serviceable condition of equipment
 - ii. maintenance procedures
 - iii. manufacturers' workshop manuals
 - iv. service bulletins
 - v. replacement and overhaul
 - vi. fault finding
 - vii. health and safety
 - viii. pre-delivery inspection (PDI)
 - ix. waste disposal
- d. Service
 - i. minor
 - ii. major
 - iii. routine
 - iv. non-routine
- e. Documentation
 - i. quality assurance
 - ii. manufacturers' data
 - iii. service and maintenance schedules and records
 - iv. repair history (proactive, periodic and continuous)
- f. Small hand-held hire equipment

Content:

- g. Hand operation
 - i. electrical powered
 - ii. engine powered
 - iii. drills
 - iv. grinders
 - v. disc cutters
 - vi. cut off saws
 - vii. sanders
 - viii. polishers
 - ix. planers
 - x. chainsaws
 - xi. brush cutters
 - xii. circular saws
 - xiii. jig saws
 - xiv. thread cutting equipment
 - xv. sprayers
- h. Non hand-held machinery
 - i. non-ride on
 - ii. ride on
 - iii. electrical powered
 - iv. engine powered
 - v. cement mixers
 - vi. wacker plates
 - vii. rollers
 - viii. compacters
 - ix. shredders
 - x. chippers
 - xi. grinders
 - xii. mowers
 - xiii. powered barrows
 - xiv. compressors
 - xv. fork lift trucks
- i. Non powered
 - i. ladders
 - ii. steps
 - iii. scaffolding
 - iv. tower scaffolds
 - v. chains
 - vi. straps
 - vii. barrows
 - viii. pallet trucks.

Fault diagnosis and test procedures on tool and plant hire machinery and equipment

- a. Perform diagnostic checks
 - i. sensory
 - ii. customer questioning
 - iii. diagnostic testing and repair
 - iv. health and safety
 - v. risk assessment
- b. Current relevant laws and regulations
 - i. Health and Safety at Work Act 1974
 - ii. COSHH regulations
 - iii. construction and use regulations
 - iv. Provision and Use of Work Equipment Regulations 1998 (PUWER)
 - v. Lifting Operations and Lifting Equipment 1998 (LOLER)
 - vi. Portable Appliance Testing (PAT)
- c. Performance
 - i. manufacturers specifications and customer requirements.

Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none"> • Hand over machinery/equipment for hire
<ul style="list-style-type: none"> • Service small hand held equipment
<ul style="list-style-type: none"> • Service non hand held equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on hand held equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on non hand held equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LEO338 - WORKING WITH LAND-BASED CONSTRUCTION PLANT MATERIALS HANDLING EQUIPMENT

Level: 3	Credit Value: 10	GLH: 60
Mapping: This unit is linked to the Land-based service engineering NOS.		
Rationale: This unit aims to introduce learners to the skills and knowledge in the maintenance and repair of 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		

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the function and specification of construction plant materials handling equipment	1.1. Explain the function of construction plant materials handling equipment 1.2. Explain the specifications of construction plant materials handling equipment 1.3. Outline the layout of key working components and assemblies of given specialist construction plant materials handling equipment
2. Understand the principles of operation of construction plant materials handling equipment	2.1. Explain principles of lifting mechanisms of materials handling equipment 2.2. Explain principles of handling mechanisms of materials handling equipment
3. Be able to carry out maintenance to construction plant materials handling equipment	3.1. Carry out maintenance to lifting and handling mechanisms of construction plant materials handling equipment 3.2. Carry out appropriate risk assessment for given procedures
4. Be able to carry out fault diagnosis and repair to construction plant materials handling equipment	4.1. Carry out (using manufacturers recommendations) fault diagnosis and repair to lifting and handling mechanisms of materials handling equipment 4.2. Describe fault diagnosis and repairs carried out

Content:

Function and specification of construction plant materials handling equipment

- a. Function
 - i. working principles
 - ii. layout of components
- b. Telehandlers
 - i. cranes (mobile, static)
 - ii. lifts
 - iii. fork lift trucks
 - iv. diggers
 - v. dumpers
 - vi. lorries
 - vii. trailers
 - viii. hoists
 - ix. hiab
 - x. excavators
 - xi. back hoe loaders
 - xii. articulated loading shovels
 - xiii. tracked loading shovels
 - xiv. skid steer loaders
 - xv. conveyors.
- c. Specification
 - i. tracked
 - ii. wheeled
 - iii. steel tracks
 - iv. rubber tracks
 - v. engine horsepower
 - vi. hydraulic capacity
 - vii. tear out
 - viii. lift capacity
 - ix. reach height
 - x. digging depth
 - xi. operator controls
 - xii. operator comfort
 - xiii. weight
 - xiv. overall dimensions.
- d. Working components:
 - i. engines
 - ii. hydraulics
 - iii. electric motors
 - iv. cables
 - v. chains
 - vi. shafts
 - vii. wheels
 - viii. tracks
 - ix. tyres
 - x. transmissions
- e. Assemblies
 - i. cable drums
 - ii. braking systems
 - iii. drive assemblies
 - iv. fail safe
 - v. steering
 - vi. control

Content:

Principles of operation of construction plant materials handling equipment

- a. Lifting mechanisms
 - i. hydraulic
 - ii. cable
 - iii. chain
 - iv. mechanical
 - v. hydrostatic
 - vi. levers
 - vii. linkages
 - viii. drive systems
 - ix. engine systems
- b. Handling
 - i. grip
 - ii. tilt
 - iii. rotate
 - iv. lift
 - v. traverse
 - vi. tyres tracks and running gear
 - vii. tyres
 - viii. rubber and steel tracks
 - ix. sprockets
 - x. idlers
 - xi. rollers
- c. Steering systems
 - i. types of steering modes (articulated steering, skid steer, tracked steering)
- d. Transmission systems
 - i. hydrostatic
 - ii. powershift
 - iii. powershuttle
 - iv. pre-select
- e. Hydraulic systems
 - i. open and closed centre
 - ii. digging
 - iii. loading.

Maintenance to construction plant materials handling equipment

- a. Maintenance
 - i. Long term
 - ii. short term
 - iii. required by manufacturers data
 - iv. hours worked
 - v. company policy
 - vi. preventative
 - vii. reasons for maintenance and servicing
 - viii. use of manufacturers
 - ix. service manuals and data
 - x. pre-use maintenance (complete service, workshop adjustments)
 - xi. security of fixtures and fastenings)
 - xii. in-use maintenance (daily pre-start checks and lubrication
 - xiii. operational/site adjustments), post-use maintenance (corrosion protection, replacement of worn parts, storage procedures)
 - xiv. strategies (proactive, predictive/ periodic and continuous, replacement)
 - xv. maintenance practices eg on-board condition monitoring
 - xvi. costs.

Content:

- a. Risk assessment
 - i. the assessment of the associated risks in carrying out the maintenance procedures health and safety
 - ii. personal protective equipment (PPE)
 - iii. risk assessments
 - iv. relevant current legislation
 - v. Health and Safety at Work etc Act 1974
 - vi. Control of Substances Hazardous to Health Regulations 2002 (COSHH)
 - vii. Provision and Use of Work Equipment Regulations 1998 (PUWER)
 - viii. Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
 - ix. environmental management of maintenance activities

Fault diagnosis and repair to construction plant materials handling equipment

- a. Fault
 - i. continuous
 - ii. intermittent
 - iii. diagnosis
 - iv. identification of faults using recognised test procedures and equipment, as required by the machine manufacturer
- b. Information gathering and evaluation
 - i. sources eg question operator
 - ii. perform diagnostic tests
 - iii. access service data/workshop manuals
 - iv. use of fault-finding charts
 - v. used oil analysis
- c. Repair
 - i. short term
 - ii. long term
 - iii. remedial
 - iv. preventative
 - v. carry out procedures which will rectify faults as diagnosed and enable the machine to continue working
- d. Repair procedures
 - i. replacement
 - ii. overhaul
 - iii. costs
 - iv. performance (manufacturers' specifications and customer requirements)
 - v. methods used to test systems and/or identify faulty components e.g. visual, road test, electronic, operator questioning
 - vi. common causes of component failure.

Evidence Requirements

<p>1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion</p>
<ul style="list-style-type: none"> • Risk assessment relating to a given repair procedure
<ul style="list-style-type: none"> • Routine maintenance to lifting and handling equipment
<ul style="list-style-type: none"> • Identifying and rectifying a fault on lifting and handling equipment

Evidence from simulated activities is acceptable for this unit.



UNIT LEO343 - UNDERTAKING LAND-BASED MACHINERY OPERATIONS

Level: 3	Credit Value: 10	GLH: 60
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Mapping: This unit is linked to the Land-based service engineering (NOS).

Rationale: This unit aims to provide learners with an understanding of the principles of land-based machinery operations and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training

LEARNING OUTCOMES	ASSESSMENT CRITERIA
The Learner will:	The Learner can:
1. Understand the purpose and operation of land-based machines	1.1. Explain the purpose and safe operation of selected land-based machines 1.2. Discuss the differences between selected land-based machines
2. Be able to prepare land-based machines ready for work	2.1. Prepare selected land-based machinery ready for work safely 2.2. Review the pre-start checks and safety requirements for selected land-based machinery
3. Be able to safely operate land-based machinery	3.1. Operate selected land-based machinery to meet given objectives safely 3.2. Explain the safe operation of selected land-based machinery
4. Be able to carry out operator maintenance and simple repairs	4.1. Carry out operator maintenance and appropriate repairs for selected land-based machinery 4.2. Assess potential faults and/or defective parts on a given land-based machine

Content:

Range
A range of modern land-based machines designed for the production of a seedbed, cutting or handling of grass swaths, application of materials, harvesting of crop.

Purpose and operation of land based machines

- a. Safe operation
 - i. need for operator training
 - ii. certification process
 - iii. Health and safety at Work etc Act1974
 - iv. Provision and Use of Work Equipment Regulations 1998 (PUWER)
 - v. Environment Act 1995
 - vi. Control of Substances Hazardous to Health 2002 (COSHH)
 - vii. Personal Protective Equipment (PPE)
 - viii. manual handling
 - ix. risk assessments
 - x. codes of practice

Content:

- b. Differences between Land-based machines
 - i. trailed or mounted
 - ii. powered or non powered
 - iii. mechanical
 - iv. electric or hydraulic powered
 - v. wheels
 - vi. skids or hydraulic pressure accumulation
 - vii. cutting
 - viii. gathering
 - ix. conveying; belts
 - x. chains
 - xi. shaft drives
 - xii. vacuum
 - xiii. pressure
 - xiv. gravity
 - xv. swath width
 - xvi. bout width
 - xvii. row width
 - xviii. depth control

Prepare land-based machines ready for work

- a. Prepare selected land-based machines
 - i. power unit suitability
 - ii. removal from storage
 - iii. cleaning
 - iv. damage inspection
 - v. correct hitching
 - vi. free movement of working components/controls
 - vii. connection to power unit
 - viii. wheel and tyre maintenance
 - ix. braking and lighting requirements
 - x. lubrication
 - xi. calibration
 - xii. tying/wrapping materials
 - xiii. initial field settings
- b. Pre-start checks
 - i. power drive shaft condition
 - ii. decontaminated
 - iii. safety overload devices
 - iv. fuel/oil requirements
 - v. tyre pressures and conditions
 - vi. lighting controls including brakes
 - vii. belt tensions
- c. Safety requirements
 - i. guards
 - ii. safety rails
 - iii. steps
 - iv. safe attachment to power unit
 - v. component security
 - vi. information decals.

Content:

Safely operate land-based machinery

- a. Operate
- b. Site risk assessments
- c. PPE
- d. Operator instruction manual
- e. Data sheets
- f. Transport/field settings
- g. Calibration check
- h. Correct power engagement
- i. Correct machine speeds
- j. Safe/correct loading of materials
- k. Machine output checks/quality of work
- l. Field procedures
- m. Terrain
- n. Ground conditions/undulations
- o. Public access
- p. Follow manufacturers' recommendations
- q. Dealer installation process
- r. Operator instruction manuals and manufacturer web sites.

Carry out operator maintenance and simple repairs

- a. Operator maintenance
 - i. manufacturers' service schedules/instructions
 - ii. lubrication
 - iii. cleaning
 - iv. assessment of wear tolerances
 - v. component replacement disposal of waste
- b. Repairs
 - i. framework welds
 - ii. joints
 - iii. distortion
 - iv. fractures
 - v. leaking pipes
 - vi. connections
- c. Potential faults
 - i. uneven groundwork
 - ii. crop damage
 - iii. inaccurate outputs
 - iv. incorrect linkage settings
 - v. incorrect drawbar settings
 - vi. uneven tyre pressures
 - vii. incorrect track widths
 - viii. power unit unsuitable
 - ix. blockages
- d. Defective parts
 - i. belts
 - ii. chains
 - iii. bearings
 - iv. loose splines
 - v. shares/tines
 - vi. blunt/missing knives
 - vii. rotor balance
 - viii. nozzles/filters
 - ix. seals.



Evidence Requirements

1. You must produce evidence of carrying out all of the different activities listed below on at least one occasion
<ul style="list-style-type: none">• Prepare land-based machinery ready for work
<ul style="list-style-type: none">• Operate land-based machinery
<ul style="list-style-type: none">• Carry out operator maintenance and simple repair

Evidence from simulated activities is acceptable for this unit.