



Agriculture, Environmental and Animal Care: Agriculture, land management and production

T Level outline content: draft version

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Introduction

Outline content

This outline content has been produced by [T Level panels](#) of employers, professional bodies and providers, and is based on the same standards as those used for apprenticeships. The outline content will form the basis of the specifications for T Level Technical Qualifications, which will be developed by awarding organisations for approval by the Institute for Apprenticeships and Technical Education. One awarding organisation will be appointed to develop and deliver each Technical Qualification following a procurement process.

Colleges and other education and training providers will decide how to structure the T Level courses they offer, based on the qualification specifications. This will enable them to deliver the study programme's mandatory components in the most effective way for students.

A T Level programme consists of a Technical Qualification, substantial industry placement, English and maths, and other occupation-specific requirements where essential for entry to skilled employment. This outline content relates solely to the Technical Qualification part of a T Level programme.

Further information about T Levels is available on the website of the Institute for Apprenticeships and Technical Education here: www.instituteforapprenticeships.org, and at www.education.gov.uk.

Agriculture, Environmental and Animal Care: Agriculture, land management and production pathway

Awarding organisations will need to ensure that students have an up-to-date knowledge of the legal and regulatory obligations relating to employment in the occupations relevant to the T Level and understand the practical implication of these on their work.

Maths, English and digital skills are set out in a separate annex. Awarding organisations should integrate these within the qualification so that they are applied in occupationally relevant contexts.

Core content

The core content relates to the whole route 'route core'. The core knowledge and understanding is assessed through an examination and core skills through a practical employer-set project.

The core knowledge and understanding focuses on the students' knowledge and understanding of contexts, concepts, theories and principles relevant to the T Level. This could include, where appropriate, assessment of knowledge and understanding relevant to the route and the pathway.

The employer-set project provides the opportunity to develop and apply a minimum range of core skills important for employability. The allocation of content to each type of assessment will need to be approved by the Institute for Apprenticeships and Technical Education.

Core knowledge and understanding across Agriculture, Environmental and Animal Care Route

Element	Content
Sustainability	<p>Key requirements of environmental legislation</p> <ul style="list-style-type: none"> • associated obligations for businesses, their employees and other stakeholders. <p>Key government environmental policies and initiatives</p> <ul style="list-style-type: none"> • the opportunities and risks they bring to agriculture, environmental and animal care sector • the associated environmental performance measure e.g. water and energy use. <p>The concept of sustainable development</p> <ul style="list-style-type: none"> • sustainable development goals at a macro (national and international) and micro (business) level • types of sustainable solutions to meet development goals including social, environmental, economic and human • concerns and expectations of key stakeholders. <p>The concept of climate change and scientific views on causes and impacts</p> <ul style="list-style-type: none"> • the impact of increased rainfall and higher temperatures upon environments, conservation practices, habitats, flora, fauna and water levels • policies and initiatives to manage these changes at national and local level. <p>Waste management principles (e.g. recycle, reduce, reuse)</p> <ul style="list-style-type: none"> • key requirements of associated legislation • types of materials that require specific actions (e.g. asbestos) • measures in place by the sector and organisation to meet requirements.

<p>Biosecurity</p>	<p>Principles of biosecurity</p> <ul style="list-style-type: none"> • factors influencing biosecurity e.g. international trade, new technologies • biosecurity risk factors in different types of agriculture, environmental and animal care situations • biosecurity measures including inspection, monitoring, regulation, passports, isolation and their importance in maintaining health production and service environments.
<p>Working in the agriculture, environmental and animal care sector</p>	<p>Employment rights and responsibilities (e.g. union membership, working hours) of the employer and employee</p> <ul style="list-style-type: none"> • expectations of professional conduct and behaviours in the workplace (including punctuality, cleanliness, respect for own and others work and work area, respect for the land, property and belongings of others (including animals) • typical activities that can lead to disciplinary and grievance procedures • how these expectations are met and demonstrated by employees. <p>Principles of effective teamwork</p> <ul style="list-style-type: none"> • how teams are developed, including the role of the team leader • team dynamics and how they are managed, and behaviours influenced • qualities of effective team members and team leaders and how these qualities are demonstrated • the importance of team work to team and project performance • techniques used to monitor and manage individual and team performance e.g. goal and objective setting, performance management reviews, providing constructive feedback • techniques used to manage team conflict (e.g. mediation) and when and how they should be applied.

<p>Working in the agriculture, environmental and animal care sector (continued)</p>	<p>Progression opportunities which exist within the agriculture, environmental and animal care sector</p> <ul style="list-style-type: none"> • the purpose of continuing professional development (CPD) and the benefits it brings to the individual and their employer • methods of personal and professional development (e.g. coaching, independent research) and the types of organisations that can provide this type of support, including professional bodies. • their suitability for achieving planned outcomes.
<p>Ethics</p>	<p>Ethical principles (e.g. honesty, transparency, justice)</p> <ul style="list-style-type: none"> • how these are used in codes of conduct, employment terms and conditions and workplace policies • how these are represented by ethical behaviours • how these are incorporated into business ethics • how these impact on business operations, including interaction with stakeholders and the supply chain.
<p>Supply Chain</p>	<p>The supply chain</p> <ul style="list-style-type: none"> • different types of organisations involved and their role • different ways in which the supply chain is sequenced and operates • implications of failing to meet supply chain demands • environmental impact of the supply chain including whole life cycle of a product • types of procurement (e.g. competitive bidding, direct purchase) and their suitability for different situations. <p>Principles of stock management (including stock rotation, storage, conditions, monitoring stock levels, ordering stock, dealing with deliveries, maintaining records)</p> <ul style="list-style-type: none"> • how they are applied in different types of business • implications to businesses of ineffective processes.

Business	<p>The types of business organisations e.g. sole trader, partnership, limited company, not for profit</p> <ul style="list-style-type: none"> • common business structures and hierarchies • the financial, legal and commercial implications of type of business • typical organisational policies and their relationship to legislation • types of business objectives and values associated with different business structures. <p>The principles of enterprise skills e.g. risk taking, innovation, resilience</p> <ul style="list-style-type: none"> • how they are applied to develop business growth and change including sales opportunities and diversification of the business • types of business risk (e.g. financial, reputational) and risk management methods that can be deployed. <p>How businesses measure success (including Key Performance Indicators (KPIs), Service Level Agreements (SLAs), benchmarking, supply chain requirements)</p> <ul style="list-style-type: none"> • the information used to determine if success measures are met • quality standards, quality control and quality assurance <ul style="list-style-type: none"> ○ their purpose, differences and application to organisations quality standards expected by internal and external stakeholders and associated quality assurance requirements e.g. audits. <p>The principles of project management (including purpose and scope of the project, milestones and timescales, supply chain, people management, resources, budgeting).</p>
Equality	<p>Factors to consider (including equality legislation, cultural differences, religious needs) when working with people from diverse backgrounds and cultures</p> <ul style="list-style-type: none"> • how to show empathy and respect to those from different backgrounds and cultures to our own • acceptable and unacceptable behaviours and language. <p>Characteristics protected by equality legislation.</p>

Communication	<p>Different types of communication (including verbal, non-verbal and digital)</p> <ul style="list-style-type: none"> • the formats used for the types of communication (e.g. business reports, emails, letters, websites) and associated business conventions • the types and value of images and visual aids to support written text and oral presentations • their suitability for different purposes and audiences • the importance of spoken language, body language and tone in communication and how each is used to convey different messages to different audiences for different purposes • the benefits and limitations of social media including risk of misuse, promoting the business.
Relationship Management	<p>Principles of customer care (including first impressions, representing business and self, supporting customers, the difference between customer wants and needs, the importance of accurate knowledge, working to an expected timescale)</p> <ul style="list-style-type: none"> • how these can be applied when dealing with different stakeholders, including internal customers • legal requirements (including legislation relating to consumer protection) when interacting with different types of customers and customer relationships including business to business (B2B) • typical procedures used to deal with customer disputes and complaints, including escalation to relevant individuals and departments • how to apply customer service principles and the benefits to the individual (e.g. increased motivation, positive feedback) and business (e.g. customer loyalty, customer confidence). <p>Roles of different stakeholders including internal and external customers</p> <ul style="list-style-type: none"> • their expectations • interrelationships between stakeholders.

Finance	<p>The concept of profit</p> <ul style="list-style-type: none"> • types of profit (including net and gross) and significance of each to business success • types of cost incurred by business (products, ancillary products, types of overheads, labour), their classifications (direct, indirect, fixed, variable) • measures used to reduce costs and implications of using these to profitability, reputation and quality • types of taxation (including payroll, business) • how costs and revenue are forecast • how profit is calculated.
Health and Safety	<p>Key requirements of health and safety legislation e.g. for lone working, safe manual handling</p> <ul style="list-style-type: none"> • the respective duties imposed on employees and employers • the importance of taking personal responsibility for health and safety of self and others • the techniques and methods used to comply with legislation e.g. use of Personal Protective Equipment (PPE), regular communication with lone workers. <p>The purpose of risk assessments</p> <ul style="list-style-type: none"> • typical structures and content • how they are developed and used • implications for poor development and application. <p>Hazards and risks associated with working in the agriculture, environmental and animal care sector (e.g. working with hazardous materials, lone working)</p> <ul style="list-style-type: none"> • typical control measures in place to minimise risks, including the types of PPE used, fatigue and stress management for lone workers. <p>Procedures to follow when dealing with emergency situations e.g. spilt cleaning materials, slurry exposure, flooding.</p>

Information and data	<p>Key requirements of legislation relating to the security of information and data</p> <ul style="list-style-type: none">• types of information and data protected by legislation including client data, intellectual property• methods used by businesses to manage information and data including version control, access controls, indexing, cyber security.
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Employer-set project

The employer-set project ensures students have the opportunity to combine core knowledge and skills to develop a substantial piece of work in response to an employer-set brief. The employer-set project forms part of the Technical Qualification and is a separate part of the T Level programme to the Industry Placement.

To ensure consistency in project scope and demand, awarding organisations will develop assessment objectives, which require students to:

- plan their approach to meeting the brief
- apply core knowledge and skills as appropriate
- select relevant techniques and resources to meet the brief
- use maths, English and digital skills as appropriate
- realise a project outcome and review how well the outcome meets the brief

The awarding organisation will work with a relevant employer or employers, to devise a set brief that:

- ensures a motivating starting point for students' projects, for example, a real-world problem to solve
- ensures students can generate evidence that covers the assessment objectives
- is manageable for providers to deliver
- is officially approved by the awarding organisation and employer

For Agriculture land management production, in achieving the assessment objectives and meeting the brief, students must demonstrate the following core skills:

- **Analysing**
 - e.g. identifying common features of data obtained on options to improve a business' environmental impact, classifying and organising data into types, discerning patterns.
- **Communicating**
 - e.g. using visual and oral methods to engage an audience with proposals for improving representation and diversity in the sector.
- **Critical thinking**
 - e.g. questioning information and data, evaluating pros and cons of the introduction of new machinery or plant into a business, taking out of the whole life cycle.

- **Decision making**

- e.g. identifying likely impact of skills scarcity in the business and using evidence to substantiate conclusions.

- **Investigating**

- e.g. developing search criteria/queries for secondary research and designing and carrying out tests for primary research into the environmental impact of a business.

- **Working in a team**

- e.g. developing and implementing a communication plan for the introduction of a new lone working policy.

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Occupational Specialist Content

Specialist content is structured into different occupational specialisms, which correspond to the apprenticeship standards listed on the relevant occupational map. Occupational specialisms ensure students develop the knowledge and skills necessary to achieve a level of competence needed to enter employment in the occupational specialism, and are organised around 'performance outcomes' that indicate what the student will be able to do, as a result of learning and applying the specified knowledge and skills.

There are some content areas that are included in both the Core and Occupational Specialism sections, this is intentional. Where in Core, it is because it is content that is applicable to all Agriculture, Environmental and Animal Care students, regardless of the occupational specialism. If the same content is also in the Occupational Specialism, it is because the knowledge and skills need to be developed within the context of the Performance Outcome. In the occupational specialism, it is therefore likely to require different content to reflect the Performance Outcome.

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Occupational Specialist Content

Occupational Specialism: Land-based engineering

Performance Outcome 1: Maintain complex land-based machinery and equipment

This performance outcome relates to scheduled and preventative maintenance and preparation for out of season storage.

Knowledge Specific to Performance Outcome	Skills
<p>Health and safety</p> <p>Hazards (e.g. release of stored energy, contaminated products) and risks associated with the maintenance of complex land-based equipment and machinery and related controls.</p> <p>Land-based equipment and machinery</p> <p>Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment)</p> <ul style="list-style-type: none"> the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) the components required to support those operating principles (e.g. drivelines, gaskets) their implications to maintenance activities. <p>How the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery influences their performance and maintenance requirements</p>	<p>Prepare the workplace/site for maintenance tasks.</p> <p>Assess health and safety risks associated with maintenance tasks.</p> <p>Determine resource (parts, materials) requirements for maintenance activities.</p> <p>Prepare machinery and equipment for maintenance tasks.</p> <p>Decontaminate machinery and equipment.</p> <p>Drain fluids.</p> <p>Clean filters.</p> <p>Fill components with fluids.</p> <p>Bleed fluid systems.</p> <p>Set machinery and equipment parameters using manual and electronic methods.</p> <p>Measure machinery and equipment parameters.</p> <p>Extract worn components from equipment and machinery e.g. sealing components.</p> <p>Insert new components into machinery and equipment e.g. air filter.</p> <p>Jack machinery and equipment.</p> <p>Stabilise raised land-based machinery and equipment.</p>

<ul style="list-style-type: none"> the implications of maintenance activities on performance of machinery and equipment. <p>The function of software (e.g. diagnostic, servicing) in the operation of machinery and equipment</p> <ul style="list-style-type: none"> how the software ensures effective performance how the software is used to support maintenance activities methods used to adapt software during and following maintenance activities e.g. installation, updating, amending. <p>Legislation</p> <p>The implications of maintenance activities to the terms and conditions of warranties and licences</p> <ul style="list-style-type: none"> terminology associated with warranties and licences. <p>Legal obligations to report issues associated with complex land-based machinery and equipment encountered during preventative maintenance activities.</p> <p>Implications of waste regulations on maintenance activities including disposal of contaminants, fluids and components.</p> <p>Maintenance operations</p> <p>Types of preventative maintenance (e.g. predictive, scheduled, out of season)</p> <ul style="list-style-type: none"> the benefits of each type implications (including financial, performance) of poor maintenance. <p>Components of typical preventative maintenance schedules (including out of season) and their application.</p>	<p>Prepare surfaces for sealing.</p> <p>Seal components.</p> <p>Classify waste products for disposals.</p> <p>Collect samples for analysis.</p> <p>Verify machinery and equipment conforms to manufacturer's specifications.</p> <p>Manage own time to meet objectives.</p> <p>Assess machinery and equipment for potential defects.</p> <p>Record activities completed, time taken, and consumables used.</p> <p>Adjust mechanisms.</p> <p>Apply preventative coatings.</p> <p>Clean machinery and equipment e.g. for out of season storage.</p>
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Factors influencing maintenance operations (e.g. machine availability and location, parts availability, timeframe)

- how they influence the planning and scheduling of maintenance tasks.

Techniques used to safely jack and support machines and equipment

- their application including the use of equipment.

Causes (e.g. brake fluids, battery acid), effect and prevention of corrosion.

Machinery and equipment samples required for completion of maintenance activities

- the contribution samples make to maintenance operations
- methods used to collect samples
- data available following analysis of samples and how these inform maintenance activities
- benchmarking data for samples that indicate optimum performance of machinery and equipment.

Causes and implications of component contamination

- measures used to avoid contamination when carrying out maintenance activities
- techniques, materials and equipment used to remove contamination where it exists.

Procedures used to remove and replace service items e.g. filters, wearing parts.

Techniques used in sealing and securing components

- their suitability for different components
- their suitability for different maintenance requirements
- tools, equipment and materials required
- their application during maintenance activities.

Types of calibration

- their suitability for different purposes, components, machinery and equipment
- equipment used for implementation
- their application during maintenance activities.

Techniques (including sensory inspection) used to verify machinery and equipment operates to specification throughout and following maintenance operations.

Techniques for cleaning complex land-based equipment and machinery (including for out of season maintenance) including techniques used for cleaning of external and internal surfaces, systems and components.

Maintenance materials

The different types of fluids (including coolants, lubricants and gases) and consumables (e.g. washers, seals) used in land-based machinery and equipment

- their applications
- their properties
- how the properties affect their application
- the effect of fluids on machinery performance

- how fluids affect maintenance activities.

Maintenance tools, equipment and machinery

Types of hand and power tools (e.g. torque wrench, dynamometer, flowmeter) used for maintenance activities

- their suitability for the maintenance task
- how they are applied and operated.

Types of equipment used for maintenance tasks (including digital hardware and software)

- their suitability for different maintenance tasks
- their operation and application.

Information and data

Post maintenance information required for the key stakeholders including owner, user and the methods of reporting e.g. service advisors, quotations

Types of information and data required to complete maintenance tasks (including technical data, customer information, service history, analysis samples) and their sources.

Maintenance information to be recorded

- types of records used (e.g. service history records, job cards)
- the information they hold
- their purpose
- the importance of accurate and timely completion
- audiences for different information e.g. manufacturer, owner.

Performance Outcome 2: Repair complex land-based machinery and equipment

Knowledge Specific to Performance Outcome	Skills
<p>Health and safety</p> <p>Hazards (e.g. welding, cutting) and risks associated with repair of complex land-based equipment and machinery and associated control.</p> <p>Land-based equipment and machinery</p> <p>Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment) the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning)</p> <ul style="list-style-type: none"> the components required to support those operating principles (e.g. drivelines, gaskets) typical causes and effects of component failure leading to repair requirements. <p>The function of software (e.g. performance, transmission) in the operation of machinery and equipment</p> <ul style="list-style-type: none"> methods used to adapt software following repair activities e.g. installation, updating, amending. <p>Legislation</p> <p>The limitations of terms and conditions of warranties and licences</p> <ul style="list-style-type: none"> associated terminology 	<p>Retrieve data from equipment and machinery software.</p> <p>Upload data to machinery and equipment software.</p> <p>Clean components.</p> <p>Release stored energy.</p> <p>Secure mechanical components to prevent movement.</p> <p>Prepare tools and e equipment prior to carrying out repair activities.</p> <p>Disassemble mechanical components.</p> <p>Extract damaged (e.g. seized, broken) fixings.</p> <p>Cut threads.</p> <p>Use equipment to support machinery and equipment being repaired.</p> <p>Mark components.</p> <p>Layout components.</p> <p>Measure components.</p> <p>Balance components.</p> <p>Flush components.</p> <p>Align mechanical components.</p> <p>Route flexible components e.g. wiring harnesses, pipes.</p> <p>Secure flexible components against chafing.</p> <p>Determine mathematically machinery and equipment parameters.</p>

<ul style="list-style-type: none"> • implications for making repairs to machinery and equipment. <p>Implications of waste regulations on repair activities including disposal of contaminants, fluids and components.</p> <p>Repair operations</p> <p>Factors influencing repair operations (e.g. severity of repair required, contractual requirements)</p> <ul style="list-style-type: none"> • how they influence the planning, allocation and scheduling of repair tasks. <p>Techniques for removal, disassembly, refitting, re-assembly of systems and components</p> <ul style="list-style-type: none"> • their suitability for different equipment and machinery and repair tasks • tools, equipment and materials required • their application when carrying out repairs. <p>Techniques used to safely jack, lift and support complex land-based machinery and equipment and their components for repair</p> <ul style="list-style-type: none"> • their application, including the use of equipment. <p>Techniques used to thermally join materials (e.g. MIG, MMA, soldering, brazing)</p> <ul style="list-style-type: none"> • their suitability for different machinery and equipment repair requirements • tools, equipment and materials required 	<p>Use equipment to confirm mechanical settings e.g. rolling resistance, torque limiting devices.</p> <p>Fit seals.</p> <p>Fit bearings.</p> <p>Make good electrical/electronic connections.</p> <p>Insulate electrical/electronic connections.</p> <p>Seal components.</p> <p>Calibrate systems.</p> <p>Calculate the cost of a repair.</p> <p>Convey technical information to different audiences.</p> <p>Allocate resources (e.g. time, materials, equipment) to a repair task.</p> <p>Remove electrical / electronic / mechanical / hydraulic components.</p> <p>Fit electrical / electronic / mechanical / hydraulic components.</p> <p>Configure electrical / electronic / mechanical / hydraulic components.</p> <p>Demonstrate physical dexterity with appropriate force and delicacy.</p> <p>Sharpen cutting components of machinery and equipment.</p>
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- their application when carrying out repairs.

Techniques used to cut and shape (including threads) materials

- their suitability for different machinery and equipment repair requirements
- tools, equipment and materials required
- their application when carrying out repair tasks.

Techniques used in sealing (including chemical bonding)

- their suitability for different repair requirements
- tools, equipment and materials required
- their application when carrying out repair activities.

Types of calibration

- their suitability for different purposes, components, machinery and equipment
- equipment used for implementation
- their application when carrying out repair activities.

Techniques used to verify repairs conform to manufacturers specifications.

Scientific laws relating to electrics, power, hydraulics and friction (e.g. Ohm's, Pascal's)

- how they are applied to complex land-based machinery and equipment

- calculations required to ensure they are applied effectively to achieve optimum performance of complex land-based machinery and equipment.

Repair materials

Types of fluids used in land-based machinery and equipment (including coolants, lubricants and gases), their applications and properties

- their applications
- their properties
- how the properties affect their application
- the effect of fluids on machinery performance
- how fluids affect repair activities.

Repair tools, equipment and machinery

Types of specialist hand and power tools used for repair activities (e.g. for protection of seals, for compression)

- their suitability for carrying out different repair tasks
- how they are applied and operated.

Types of equipment (e.g. rails, lifting) used for repair tasks (including electronic)

- their suitability for use in different repair tasks
- their operation and application.

Information and data

<p>Pre and post repair information required from and by the key stakeholders including owner, user.</p> <p>Conventions and symbols associated with drawings and schematics and their use in interpreting information provided.</p> <p>Types of information and data required to complete repair tasks (e.g. service records, drawings, schematics) and their sources.</p> <p>Types of repair records (e.g., quotations, insurance reports)</p> <ul style="list-style-type: none">• the information they hold• their purpose• the importance of accurate and timely completion. <p>Costs associated with repair operations including parts, labour, surcharges, specialist costs (e.g. coded welding, crack detection, specialist machining)</p> <ul style="list-style-type: none">• difference between quotations and estimates including content and purpose• implications to the business of each.	
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Performance Outcome 3: Diagnose complex land-based machinery and equipment faults

Students must develop skills to carry out diagnostic activities on hydraulic, electronic and technologically advanced systems on complex land-based engineering machinery and equipment.

Knowledge Specific to Performance Outcome	Skills
<p>Health and safety</p> <p>Site related hazards (e.g. animals, diseases) and risks associated with conducting complex diagnostic activities on land-based equipment and machinery and associated controls.</p> <p>Land-based equipment and machinery</p> <p>Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment)</p> <ul style="list-style-type: none"> the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) and their components (e.g. drivelines, gaskets) how systems interrelate and affect each other. <p>How the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery can be used to support a diagnosis.</p> <p>Causes and effects of system and component failure.</p> <p>Normal and abnormal characteristics of machinery performance.</p>	<p>Gather information from different sources.</p> <p>Prepare machinery and equipment for diagnostic activities.</p> <p>Verify test equipment accuracy.</p> <p>Sequence and prioritise diagnostic tasks.</p> <p>Apply open questioning and listening techniques.</p> <p>Simulate machinery and equipment operations to replicate fault symptoms.</p> <p>Use test equipment (e.g. electrical, hydraulic) to establish diagnostic data.</p> <p>Use digital software to collect diagnostic information.</p> <p>Connect electronic components to software.</p> <p>Record diagnostic data.</p> <p>Use visual inspection and sensory perception to establish diagnostic information.</p> <p>Isolate circuits and components in a system.</p> <p>Analyse information and data.</p> <p>Present information and data.</p> <p>Convey proposals in written form.</p> <p>Measure with precision.</p>

<p>The function of software (e.g. engine control systems, machine stability) in the operation of machinery and equipment.</p> <ul style="list-style-type: none"> • how the software ensures effective performance • how software can be used to support diagnostic activities • methods used to adapt software to support diagnostic activities including installation, updating, amending, licensing. <p>Diagnostic operations</p> <p>Causes and implications of component contamination</p> <ul style="list-style-type: none"> • measures used to avoid contamination when carrying out diagnostic activities • how evidence of contamination can be used to support a diagnosis. <p>Machinery and equipment samples required for completion of diagnostic activities.</p> <ul style="list-style-type: none"> • the contribution samples make to diagnostic activities • methods used to collect samples • how data provided from sample analysis can be used to support a diagnosis • benchmarking data for samples that indicate optimum performance of machinery and equipment. <p>Current and emerging technologies and their effect on system operation, integration and diagnostics.</p> <p>Techniques used in the preparation of machinery and equipment before diagnostic activities</p>	<p>Validate data.</p> <p>Configure digital technology.</p> <p>Use software to manipulate data.</p> <p>Manipulate software to interrogate data.</p> <p>Substantiate conclusions with evidence.</p> <p>Apply a logical approach to solving problems.</p> <p>Sequence and prioritise diagnostic tasks.</p> <p>Synthesise provided information.</p>
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- their suitability for different diagnostic activities, machinery and equipment and environments
- their application for different machinery and equipment and environments.

Techniques for removal, disassembly, refitting, assembly of systems and components in preparation for diagnostic operations.

Diagnostic techniques (including sensory, electronic, benchmarking, monitoring)

- their purpose
- their suitability for different situations
- their application.

The processes used to formulate a logical diagnostic conclusion e.g. isolation, substitution, comparison.

Methods used to verify machinery and equipment and their components conform to manufacturers specifications.

Types of calibration

- their suitability for different purposes
- techniques and equipment used for implementation.

Scientific laws relating to electrics, power, hydraulics and friction (e.g. Ohm's, Pascal's)

- how they are applied to complex land-based machinery and equipment
- calculations required to ensure they are applied effectively to achieve optimum performance of complex land-based machinery and equipment.

Diagnostic tools, equipment and machinery

Types of tools, equipment and machinery used for diagnostic tasks (including mechanical, electronic, digital)

- their characteristics
- their operation
- their calibration.

Techniques used to maintain equipment and machinery for use including storage, cleaning, visual and technical checks.

Information and data

Information that can be provided by the key stakeholders (including owner, user) to support a diagnosis.

Methods used to verify the accuracy of information provided by key stakeholders e.g. observation, machinery operation.

Information and data required to support diagnostic tasks

- techniques used obtain data
- suitability of techniques for different types of data and situations.

Conventions of diagnostic reports, complex drawings and schematics (wiring and hydraulics) including symbols

- how these are used to interpret and present information and data.

Performance Outcome 4: Install land-based machinery and equipment

Students are not required to demonstrate the use and operation of complex land-based machinery and equipment which would normally be included in the installation and handover process. They must be able to apply their knowledge of complex land-based machinery and equipment to any example from any manufacturer, when provided with relevant and appropriate information and data.

Knowledge Specific to Performance Outcome	Skills
<p>Health and safety</p> <p>Hazards and risks associated with the installation of complex land-based equipment and machinery and related controls.</p> <p>Land-based equipment and machinery</p> <p>Types of complex land-based equipment and machinery including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment.</p> <p>The operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning)</p> <ul style="list-style-type: none"> • their components (e.g. drivelines, gaskets) • how components and systems interrelate and affect each other. <p>Equipment and machinery applications</p> <ul style="list-style-type: none"> • their performance limitations • causes and effects of inappropriate system, machinery or equipment use • implications for incorrect use. <p>The function of software (e.g. global positioning) in the operation of machinery and equipment</p>	<p>Plan the logistics required to carry out a machinery and equipment installation.</p> <p>Assess suitability of an installation site.</p> <p>Prepare the site to enable safe and effective installation of machinery and equipment.</p> <p>Interpret information and data provided e.g. operator's manual, customer reviews.</p> <p>Summarise information.</p> <p>Convey technical information to different audiences.</p> <p>Verify machinery and equipment is prepared to requirements e.g. customer order.</p> <p>Use open and closed questions to gain information.</p> <p>Present information and ideas orally to others.</p> <p>Check understanding of others.</p>

- how the software ensures effective performance
- how the software is used to support maintenance activities
- methods used to adapt software during and following maintenance activities including installation, updating, amending, licensing.

The relationships between the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery and the implications for installation and handover information and activities.

Types of fluids used in land-based machinery and equipment (including coolants, lubricants and gases),

- their properties
- how the properties affect their application and performance.

Techniques (including sensory inspection) used to verify machinery and equipment operates to specification after installation.

Current and emerging technologies and their effect on system operation and integration.

Legislation

The legal requirements when installing and handing over a new or used machine including the technical advice and assistance that can be offered to customers.

The benefits and limitations of terms and conditions of warranties (including extended warranties) and licences

- terminology associated with warranties and licences.

Installation Operations

The requirements for preparing machinery and equipment to be presented and installed with the owner / operator e.g. checking customer order, cleanliness, operational checks, performance capabilities.

Characteristics of installation sites (e.g. noise levels, potential bystanders, space, topography)

- their suitability for specific installation requirements
- actions required to ensure the site is suitable.

Handover of Machine

The techniques used to establish that the machine operator can operate the installed machine and understands information provided on completion of the installation e.g. (observation, questioning, demonstration).

The processes used to establish customer satisfaction e.g. customer satisfaction surveys, customer visits.

Types of customer related issues that may be encountered when installing and handing over machinery equipment and how they arise (e.g. customer expectations, machine performance).

The information required by the operator as part of the handover including how to operate machinery and equipment, the safe stop procedure and reasons for use, the importance of the operator's handbook, the meaning of universal symbols in the operator's handbook, maintenance and

<p>warranty requirements, the importance of serial numbers, issues related to second-hand equipment and machinery.</p> <p>Information and data</p> <p>The information, documentation and equipment required prior to installing machinery and equipment.</p> <p>The information required to complete the installation documentation, including acceptance criteria and meet legislative requirements.</p>	
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