

City & Guilds Level 2 Certificate, Extended Certificate and Diploma in Land-based Technology (0075- 02)



Qualification handbook for centres

501/0677/6

501/0683/1

501/0678/8



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City & Guilds Level 2 Certificate, Extended Certificate and Diploma in Land-based Technology (0075-02)

Qualification handbook for centres

Qualification title	Number	QAN
City & Guilds Level 2 Certificate in Land-based Technology	0075-02	501/0677/6
City & Guilds Level 2 Extended Certificate in Land-based Technology	0075-02	501/0683/1
City & Guilds Level 2 Diploma in Land-based Technology	0075-02	501/0678/8

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Unit 214	Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment	100
Unit 215	Service and Repair Tyres and Tracks on Land-based Equipment	106
Unit 216	Service and Repair Land-based Cutting and Mowing Equipment	116
Unit 217	Service and Repair Land-based Harvesting and Processing Equipment	122
Unit 218	Service and Repair Land-based Soil Preparation and Plant Establishment Equipment	127
Unit 219	Service and Repair Land-based Transport, Handling and Storage Equipment	133
Unit 220	Service and Repair Electrical Systems on Land-based Equipment	140
Unit 221	Service and Repair Hydraulic Systems and Components on Land-based Equipment	146
Unit 222	Service and Repair Pneumatic Systems and Components for Land-based Equipment	151
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1 Introduction to the qualifications

This document contains the information that centres need to offer the following qualifications:

Qualification title and level	City & Guilds qualification number	Qualification accreditation number
Level 2 Certificate in Land-based Technology	0075-02	501/0677/6
Level 2 Extended Certificate in Land-based Technology	0075-02	501/0683/1
Level 2 Diploma in Land-based Technology	0075-02	501/0678/8

Qualification summary

Qualification title and level	Credits	Guided learning Hours	Total Qualification Time
Level 2 Certificate in Land-based Technology	15	90	150
Level 2 Extended Certificate in Land-based Technology	30	180	300
Level 2 Diploma in Land-based Technology	60	360	600

These qualifications meet the needs of learners in a centre-based environment who may wish to work within the land-based technology industry or progress to further learning and/or training. These qualifications allow learners to develop underpinning knowledge whilst practising skills that could be used within employment in the land-based technology industry.

These qualifications were developed in association with Lantra SSC, Landex and the industry.

Specialist Learning (SL)

Specialist Learning (SL) offers young people the opportunity to study a particular topic in more depth or broaden their studies through complementary learning. The Level 2 Certificate, Extended Certificate and Diploma in Land-based Technology have been approved as SL by the Environmental and Land-based Diploma DDP and Ofqual for the Higher Diploma in Environmental and Land-based Studies. They have been designed to:

- complement principal learning within the Higher Diploma in Environmental and Land-based Studies
- provide a broad background understanding of the Environmental and Land-based sector and an introduction to the practical skills and knowledge required
- provide an awareness of the range of jobs and work settings in the Land-based engineering sector
- enable learners to make an informed assessment of their own aptitude for work in this sector and to make informed decisions about careers
- encourage learners to reach a level of knowledge and skills that will facilitate progress into further vocational learning or to potential employment in the sector
- introduce learners to the discipline of the working environment and to encourage mature attitudes to the community in general
- encourage learners to value continued learning and remain in the learning process
- allow learners to learn, develop and practise selected skills required for progression in the sector
- provide opportunities for progression to the Higher Diploma in Environmental and Land-based and other related qualifications in the sector.

1.1 Qualification structure

Level 2 Certificate

To achieve the **Level 2 Certificate in Land-based Technology**, learners must achieve 15 credits from the any of the units indicated in the table below.

Unit accreditation number	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
L/600/3433	Unit 201	Land-based Engineering Operations – Applying Mechanical Principles	Optional	5
R/600/3434	Unit 202	Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment	Optional	5
F600/3431	Unit 203	Land-based Engineering Operations – Material Preparation, Shaping and Assembling	Optional	10
R/601/5311	Unit 204	Monitor and Maintain Health and Safety in a Land-based Engineering Work Area	Optional	10
F/600/3428	Unit 205	Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment	Optional	10
A/600/3427	Unit 208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
T/600/3426	Unit 209	Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems	Optional	5
K/600/3424	Unit 210	Land-based Engineering Operations – Service and Repair Engines and Components	Optional	10
H/600/3423	Unit 211	Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment	Optional	5
Y/600/3421	Unit 212	Service and Repair Mechanical Transmissions on Land-based Equipment	Optional	10
R/600/3420	Unit 213	Service and Repair Braking Systems on Land-based Equipment	Optional	5
D/600/3419	Unit 214	Service and Repair Wheeled and Tracked Steering Systems on land-based Equipment	Optional	5

T600/3409	Unit 216	Service and Repair Land-based Cutting and Mowing Equipment	Optional	5
A/600/3430	Unit 223	Land-based Engineering Operations – Use Calculations	Optional	5
F/600/9794	Unit 226	Introduction to Land-based Workshop Practice	Optional	10
T/600/9596	Unit 227	Introduction to Land-based Machinery Operations	Optional	10

Level 2 Extended Certificate

To achieve the **Level 2 Extended Certificate in Land-based Technology**, learners must achieve 30 credits from the any of the units indicated in the table below.

Unit accreditation number	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
L/600/3433	Unit 201	Land-based Engineering Operations – Applying Mechanical Principles	Optional	5
R/600/3434	Unit 202	Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment	Optional	5
F/600/3431	Unit 203	Land-based Engineering Operations – Material Preparation, Shaping and Assembling	Optional	10
R/601/5311	Unit 204	Monitor and Maintain Health and Safety in a Land-based Engineering Work Area	Optional	10
F/600/3428	Unit 205	Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment	Optional	10
F/600/3400	Unit 206	Understand and Follow Organisational Procedures within Land-based Engineering Establishments	Optional	5
A/600/3427	Unit 208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
T/600/3426	Unit 209	Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems	Optional	5
K/600/3424	Unit 210	Land-based Engineering Operations – Service and Repair Engines and Components	Optional	10
H/600/3423	Unit 211	Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment	Optional	5
Y/600/3421	Unit 212	Service and Repair Mechanical Transmissions on Land-based Equipment	Optional	10
R/600/3420	Unit 213	Service and Repair Braking Systems on Land-based Equipment	Optional	5

D/600/3419	Unit 214	Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment	Optional	5
K/600/3410	Unit 215	Service and Repair Tyres and Tracks on Land-based Equipment	Optional	5
T/600/3409	Unit 216	Service and Repair Land-based Cutting and Mowing Equipment	Optional	5
M/600/3408	Unit 217	Service and Repair Land-based Harvesting and Processing Equipment	Optional	10
K/600/3407	Unit 218	Service and Repair Land-based Soil Preparation and Plant Establishment Equipment	Optional	10
H/600/3406	Unit 219	Service and Repair Land-based Transport, Handling and Storage Equipment	Optional	10
Y/600/3404	Unit 220	Service and Repair Electrical Systems on Land-based Equipment	Optional	10
L/600/3402	Unit 221	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Optional	10
J/600/3401	Unit 222	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5
A/600/3430	Unit 223	Land-based Engineering Operations – Use Calculations	Optional	5
F/600/9794	Unit 226	Introduction to Land-based Workshop Practice	Optional	10
T/600/9596	Unit 227	Introduction to Land-based Machinery Operations	Optional	10

Level 2 Diploma

To achieve the **Level 2 Diploma in Land-based Technology**, learners must achieve 60 credits of which 40 must be from the Mandatory units indicated below. The remaining 20 credits can be made up of any combination of units from the table.

Unit accreditation number	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
L/600/3433	Unit 201	Land-based Engineering Operations – Applying Mechanical Principles	Mandatory	5
R/600/3434	Unit 202	Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment	Mandatory	5
F/600/3431	Unit 203	Land-based Engineering Operations – Material Preparation, Shaping and Assembling	Mandatory	10
R/601/5311	Unit 204	Monitor and Maintain Health and Safety in a Land-based Engineering Work Area	Mandatory	10
F/600/3428	Unit 205	Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment	Mandatory	10
F/600/3400	Unit 206	Understand and Follow Organisational Procedures within Land-based Engineering Establishments	Optional	5
Y/600/3435	Unit 207	Provide Customer Care within Land-based Engineering Operations	Optional	5
A/600/3427	Unit 208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
T/600/3426	Unit 209	Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems	Optional	5
K/600/3424	Unit 210	Land-based Engineering Operations – Service and Repair Engines and Components	Optional	10
H/600/3423	Unit 211	Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment	Optional	5
Y/600/3421	Unit 212	Service and Repair Mechanical Transmissions on Land-based Equipment	Optional	10

R/600/3420	Unit 213	Service and Repair Braking Systems on Land-based Equipment	Optional	5
D/600/3419	Unit 214	Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment	Optional	5
K/600/3410	Unit 215	Service and Repair Tyres and Tracks on Land-based Equipment	Optional	5
T/600/3409	Unit 216	Service and Repair Land-based Cutting and Mowing Equipment	Optional	5
M/600/3408	Unit 217	Service and Repair Land-based Harvesting and Processing Equipment	Optional	10
K/600/3407	Unit 218	Service and Repair Land-based Soil Preparation and Plant Establishment Equipment	Optional	10
H/600/3406	Unit 219	Service and Repair Land-based Transport, Handling and Storage Equipment	Optional	10
Y/600/3404	Unit 220	Service and Repair Electrical Systems on Land-based Equipment	Optional	10
L/600/3402	Unit 221	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Optional	10
J/600/3401	Unit 222	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5
A/600/3430	Unit 223	Land-based Engineering Operations – Use Calculations	Optional	5
H/600/9335	Unit 224	Undertake Work Related Experience in the Land-based Industries	Optional	10
F/600/9357	Unit 225	Environmental and Land-based Business	Optional	10
F/600/9794	Unit 226	Introduction to Land-based Workshop Practice	Optional	10
T/600/9596	Unit 227	Introduction to Land-based Machinery Operations	Optional	10

1.2 Opportunities for progression

On completion of these qualifications learners may progress into employment or to the following City & Guilds qualifications:

- Level 3 Certificate, Subsidiary Diploma, Diploma, Extended Diploma in Land-based Technology
- Level 2 or 3 qualifications in Work-based Land-based Service Engineering Operations
- Other related qualifications.

1.3 Qualification support materials

City & Guilds Land Based Services also provides the following publications and resources specifically for these qualifications:

Description	How to access
Assignment guide	www.cityandguilds.com
Marking guide	information@cityandguilds.com
Information sheets	www.cityandguilds.com
Fast track approval forms/generic fast track approval form	www.cityandguilds.com

2 Centre requirements

This section outlines the approval processes for Centres to offer these qualifications and any resources that Centres will need in place to offer the qualifications including qualification-specific requirements for Centre staff.

There is no fast track approval provision for this qualification.

Existing centres wishing to offer this qualification must use the standard Qualification Approval Process.

2.1 Resource requirements

Human resources

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be technically competent in the areas for which they are delivering training and/or have experience of providing training. This knowledge must be at least to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- be occupationally knowledgeable in the area of land-based technology for which they are delivering training. This knowledge must be at least to the same level as the training being delivered
- have credible experience of providing training.

Centre staff may undertake more than one role, e.g. tutor and assessor or internal verifier, but must never internally verify their own assessments.

Assessors and internal verifiers

The centre must provide Assessor personnel who must be occupationally competent in the industry either qualified to at least level 2 and/or have current experience of working in the industry at this level.

The centre must provide Internal Quality Assurance personnel who must be occupationally competent in the land-based sector either qualified to at least level 2 and/or have current experience of working in the industry at this level.

Assessors/Internal Quality Assurance personnel may hold relevant qualifications such as D32/33/34 or A1/V1 or TAQA however they are not a mandatory requirement for this qualification. They should have had formal training in assessment/IQA, which may be the qualifications above, or other training that allows the assessor to demonstrate competence in the practice of assessment/IQA. This training may be carried out in-house or with an external agency.

TAQA qualifications are considered very appropriate as Continuing Professional Development (CPD) or as best practice standards for new centre staff to work towards.

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and verification, and that it takes account of any national or legislative developments.

2.2 Learner entry requirements

There are no formal entry requirements for learners undertaking these qualifications. However, centres must ensure that learners have the potential and opportunity to gain the qualifications successfully.

As part of the assessment for the City & Guilds qualification, learners must have access to a work setting/placement for the work experience unit.

Age restrictions

These qualifications have been approved and accredited for pre-16, 16-18, 18+ and 19+ learners. However, there are no age limits attached to learners undertaking the qualification unless this is a legal requirement of the process or the environment.

3 Course design and delivery

3.1 Initial assessment and induction

Centres will need to make an initial assessment of each learner prior to the start of their programme to ensure they are entered for an appropriate type and level of qualification.

The initial assessment should identify:

- any specific training needs the learner has, and the support and guidance they may require when working towards their qualifications. This is sometimes referred to as diagnostic testing.
- any units the learner has already completed, or credit they have accumulated which is relevant to the qualifications they are about to begin.

City & Guilds recommends that centres provide an induction programme to ensure the learner fully understands the requirements of the qualifications they will work towards, their responsibilities as a learner, and the responsibilities of the centre. It may be helpful to record the information on a learning contract.

3.2 Recommended delivery strategies

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Centres may design course programmes of study in any way which:

- best meets the needs and capabilities of their learners
- satisfies the requirements of the qualifications.

When designing and delivering the course programme, centres might wish to incorporate other teaching and learning that is not assessed as part of the qualifications. This might include the following:

- Functional skills
- Personal learning and thinking skills (PLTS)

Where applicable, this could involve enabling the learner to access relevant qualifications covering these skills.

4 Assessment

4.1 Summary of assessment methods

For these qualifications, learners will be required to complete the following assessments:

- **one** assignment for **each** unit

City & Guilds provides the following assessments:

- Assignment guide containing assignments for each unit

Time constraints

The following time constraints must be applied to the assessment of these qualifications:

- All assignments must be completed and assessed within the learner's period of registration. Centres should advise learners of any internal timescales for the completion and marking of individual assignments.

4.2 Assignments

The assignment guide for these qualifications is available to download from www.cityandguilds.com.

4.3 Recognition of prior learning (RPL)

Recognition of Prior Learning (RPL) recognises the contribution a person's previous experience could contribute to a qualification. RPL is allowed and is also sector specific.

4.4 Resubmission of assignments

Centres are advised to adopt the following policy on the re-submission of work:

Learners who fail an assignment on the formal (summative) submission, or who would like the opportunity to improve their grade, may re-submit once only and may then achieve either a Pass, Merit or Distinction as appropriate. An appropriate time period between formal submission and re-submission should be set by the centre. Multiple re-submissions are not permitted. Learners who fail to hand in work on the formal submission date, where there is no legitimate reason, should be capped to a maximum of a Pass grade only at the re-submission stage. It is at the discretion of the centre to set informal (formative) submission dates, if appropriate, and a formal submission date.

5 Units

Summary of units

City & Guilds unit number	Title	QCF unit number	Credits
201	Land-based Engineering Operations – Applying Mechanical Principles	L/600/3433	5
202	Land-based Engineering Operations – Understand how to Use, Service and Maintain Tools and Equipment	R/600/3434	5
203	Land-based Engineering Operations – Material Preparation, Shaping and Assembling	F/600/3431	10
204	Monitor and Maintain Health and Safety in a Land-based Engineering Work Area	R/601/5311	10
205	Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment	F/600/3428	10
206	Understand and Follow Organisational Procedures within Land-based Engineering Establishments	F/600/3400	5
207	Provide Customer Care within Land-based Engineering Operations	Y/600/3435	5
208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	A/600/3427	10
209	Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems	T/600/3426	5
210	Land-based Engineering Operations – Service and Repair Engines and Components	K/600/3424	10
211	Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment	H/600/3423	5
212	Service and Repair Mechanical Transmissions on Land-based Equipment	Y/600/3421	10
213	Service and Repair Braking Systems on Land-based Equipment	R/600/3420	5
214	Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment	D/600/3419	5
215	Service and Repair Tyres and Tracks on Land-based Equipment	K/600/3410	5
216	Service and Repair Land-based Cutting and Mowing Equipment	T/600/3409	5
217	Service and Repair Land-based Harvesting and Processing Equipment	M/600/3408	10
218	Service and Repair Land-based Soil Preparation and Plant Establishment Equipment	K/600/3407	10
219	Service and Repair Land-based Transport, Handling and Storage Equipment	H/600/3406	10
220	Service and Repair Electrical Systems on Land-based Equipment	Y/600/3404	10
221	Service and Repair Hydraulic Systems and Components on Land-based Equipment	L/600/3402	10
222	Service and Repair Pneumatic Systems and Components for Land-based Equipment	J/600/3401	5
223	Land-based Engineering Operations – Use	A/600/3430	5

	Calculations		
224	Undertake Work Related Experience in the Land-based Industries	H/600/9335	10
225	Environmental and Land-based Business	F/600/9357	10
226	Introduction to Land-based Workshop Practice	F/600/9794	10
227	Introduction to Land-based Machinery Operations	T/600/9596	10

Certification/grading modules

City & Guilds unit number	Title
901	Certification module for Level 2 Certificate in Land-based Technology – pass grade
902	Certification module for Level 2 Certificate in Land-based Technology – merit grade
903	Certification module for Level 2 Certificate in Land-based Technology – distinction grade
904	Certification module for Level 2 Extended Certificate in Land-based Technology – pass grade
905	Certification module for Level 2 Extended Certificate in Land-based Technology – merit grade
906	Certification module for Level 2 Extended Certificate in Land-based Technology – distinction grade
907	Certification module for Level 2 Diploma in Land-based Technology – pass grade
908	Certification module for Level 2 Diploma in Land-based Technology – merit grade
909	Certification module for Level 2 Diploma in Land-based Technology – distinction grade
922	Certification module for Level 2 Certificate in Land-based Technology – distinction* grade
923	Certification module for Level 2 Extended in Land-based Technology – distinction* grade
924	Certification module for Level 2 Diploma in Land-based Technology – distinction* grade

6 Registration and Certification

The Level 2 Certificate, Extended Certificate and Diploma in Land-based Technology qualifications have been grouped into one programme for registration.

Tutors and Examination Officers should ensure that learners are registered onto 0075-02 and that all 0075-02 documentation for teaching and administration with City & Guilds is used.

When learners' results are submitted to City & Guilds, centres should also submit the relevant Certificate, Extended Certificate and Diploma component, according to which units the learner has achieved, so that the appropriate certificate is generated. The overall grade can be calculated using the formula in the assignment guide.

Please note: There are four certification/grading modules for each of the qualifications which differentiates the four grades – pass, merit, distinction and distinction*. Once the overall grade for the assignments has been calculated, the correct certification/grading module needs to be indicated on the results entry.

For example, if a learner achieves the Level 2 Certificate in Land-based Technology at an overall merit grade, then the certification module 902 needs to be submitted. Please see the Rules of Combination below or the City & Guilds catalogue.

Level 2 Certificate in Land-based Technology QAN 501/0677/6	
Rules for achievement of qualification	15 credits from (201-205, 208-214, 216, 223, 226-227) Plus 901 for certification at pass grade

Level 2 Certificate in Land-based Technology QAN 501/0677/6	
Rules for achievement of qualification	15 credits from (201-205, 208-214, 216, 223, 226-227) Plus 902 for certification at merit grade

Level 2 Certificate in Land-based Technology QAN 501/0677/6	
Rules for achievement of qualification	15 credits from (201-205, 208-214, 216, 223, 226-227) Plus 903 for certification at distinction grade

Level 2 Certificate in Land-based Technology QAN 501/0677/6	
Rules for achievement of qualification	15 credits from (201-205, 208-214, 216, 223, 226-227) Plus 922 for certification at distinction* grade

Level 2 Extended Certificate in Land-based Technology QAN 501/0683/1	
Rules for achievement of qualification	30 credits from (201--206, 208-223, 226-227) Plus 904 for certification at pass grade

Level 2 Extended Certificate in Land-based Technology QAN 501/0683/1	
Rules for achievement of qualification	30 credits from (201-206, 208-223, 226- 227) Plus 905 for certification at merit grade

Level 2 Extended Certificate in Land-based Technology QAN 501/0683/1	
Rules for achievement of qualification	30 credits from (201-206, 208-223, 226-227) Plus 906 for certification at distinction grade

Level 2 Extended Certificate in Land-based Technology QAN 501/0683/1	
Rules for achievement of qualification	30 credits from (201-206, 208-223, 226-227) Plus 923 for certification at distinction* grade

Level 2 Diploma in Land-based Technology QAN 501/0678/8	
Rules for achievement of qualification	40 credits from (201-205) Minimum 20 credits from (206-227) Plus 907 for certification at pass grade

Level 2 Diploma in Land-based Technology QAN 501/0678/8	
Rules for achievement of qualification	40 credits from (201-205) Minimum 20 credits from (206-227) Plus 908 for certification at merit grade

Level 2 Diploma in Land-based Technology QAN 501/0678/8	
Rules for achievement of qualification	40 credits from (201-205) Minimum 20 credits from (206-227) Plus 909 for certification at distinction grade

Level 2 Diploma in Land-based Technology QAN 501/0678/8	
Rules for achievement of qualification	40 credits from (201-205) Minimum 20 credits from (206-227) Plus 924 for certification at distinction* grade

- Learners must be registered at the beginning of their course. Centres should submit registrations using Walled Garden or Form S (Registration), under scheme/complex 0075-02.
- When assignments have been successfully completed results should be submitted on Walled Garden or Form S (Results submission). One of the certification/grading modules 901 to 909 or 922 to 924 need to be submitted to generate the appropriate certificate and grade. Centres should note that results will not be processed by City & Guilds until verification records are complete.
- Learners achieving one or more assessment components will receive a Certificate of Unit Credit listing the assessment components achieved. Learners achieving the number and combination of assessment components required to meet a defined Rule of Combination will,

in addition, be issued with a certificate. Centres must submit a certification/grading component to allow this to happen.

Full details on the procedures for all City & Guilds qualifications registered and certificated through City & Guilds can be found on the City & Guilds on-line catalogue.

Unit 201

Land-based Engineering Operations – Applying Mechanical Principles

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of mechanical engineering 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.

The aim of this unit is to provide the learner with the knowledge, and skills required to apply mechanical engineering principles within land based engineering operations.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to apply mechanical engineering principles.
2. Know how to apply mechanical engineering principles

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO4.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 201 **Land-based Engineering Operations – Applying Mechanical Principles**

Outcome 1 Be able to apply mechanical engineering principles.

Assessment Criteria

The learner can:

1. Remove and refit **components** to suit **application** and manufacturers specification
2. Test and verify **power transmission** and **securing devices**
3. Check **components and machines for static and dynamic balance** and stability
4. Set linkages and select **components to gain optimal mechanical advantage**

Range

Hand held, pedestrian controlled, self propelled, attachments (mounted and trailed)

Unit content

Components

Power transmission components – belts, chains, gears, levers, pulleys
Power unit, linkage, wheels, tyres, cutting devices, wearing components

Application

Fitted to any machine within the range specified the above

Power transmission

Method connecting power unit to driven unit – belts, chains, gears, levers, pulleys
Alignment, rolling resistance, slip

Securing devices

Nuts (torque setting), bolts, rivets, chemical bonding
Clearance fit

Components and machines for static and dynamic balance

Crankshaft, pulley, flywheel, wheels/tyres

Components to gain optimal mechanical advantage

Pulleys, gears, levers, belts, chains

Unit 201 Land-based Engineering Operations – Applying Mechanical Principles

Outcome 2 Know how to apply mechanical engineering principles

Assessment Criteria

The learner can:

1. Describe the application, **installation** and **maintenance** of **bearings**
2. Describe the use of **specialist tools** to install and maintain components
3. Describe the **construction, characteristics and fitting methods** of **seals**
4. Describe how directional rotation, reciprocating movement, timing and balance are achieved

Unit content

Installation

Bearing removal and refitting, securing

Maintenance

Bearing inspection, lubrication, installation

Bearing protection, alignment shimming

Specialist tools

Torque wrenches, feeler gauges, spring balance (rolling resistance), precision measuring equipment

Construction, characteristics

Material, sealing method/ type

Fitting method of seals

Removal and refitting, lubrication, manufacturer's recommendations, protection

Unit 201 Land-based Engineering Operations – Applying Mechanical Principles

Notes for guidance

This unit aims to develop learners understanding of mechanical engineering principles and provides learners with the opportunity to develop their practical engineering skills.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery maintenance under close supervision, and this is the same for any unit within the qualification that requires the learner to operate or use machinery. At all times practical maintenance tasks should be carried out to manufacturers' specifications.

There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1, the learner will investigate the basic mechanical principles, fasteners, mechanical advantage, power transmission, and balance of components.

Delivery will have a high practical emphasis. Removal and refitting of components will help the learner to understand the importance of using the correct alignment, fittings and components to transmit power efficiently, and at the correct ratio.

A full spectrum of fasteners should be covered including bolts and rivets. Learners will also need to gain an understanding of the need for correct torque settings, clearance/interference fit, and when the correct type of chemical bonding is required.

Learners will need sufficient supervised practical experience to enable them to explore the choice of linkages (length and position), levers and pulleys (size combination), building an understanding of why certain transmission systems are chosen, and what happens when ratios are changed. Learners could also experience statically balancing a wheel and tyre and then verifying the static method through the use of a dynamic tyre balancing machine.

In outcome 2, delivery is likely to include classroom based activity to help learners to develop their understanding of mechanical engineering principles, together with practical sessions and demonstrations to add relevance and context.

Delivery should enable the learner to investigate the different types of bearings, when and where they are used, and how they are sealed. A full range of bearings and seals must be covered, along with the tools needed to remove and refit them correctly. This can be taught through a mixture of practicals and taught theory lessons, ensuring the learner has sufficient time to develop their knowledge.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X
- Hillier V and Coombes P — *Hillier's Fundamentals of Motor Vehicle Technology, 5th Edition* (Nelson Thornes, 2004) ISBN 0748780823
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- Manufacturer's publications and manuals

Journals

Farmers Guardian
Profi International
Farmers Weekly

Websites

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www.defra.gov.uk	Dept for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 202

Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of selecting, using, servicing and maintaining tools and equipment 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to select, use and maintain tools and equipment used within land based engineering operations.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to select, safely use, service and maintain tools and equipment
2. Know how to select, use and maintain tools and equipment appropriate to the task

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO5.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 202 **Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment**

Outcome 1 Be able to select, safely use, service and maintain tools and equipment

Assessment Criteria

The learner can:

1. **Identify, select and safely use** tools and equipment

Range

Tools

Hand, air and electric power tools, fixed and portable equipment, taps and dies, reamers, drill bits, measuring and marking equipment, tools for thread identification and maintenance

Specialist and test equipment

Engine testing, fuel, hydraulic, electrical and temperature, tools for dismantling and reassembling, fabrication, supporting, clamping, compressing, extracting, lifting and slinging

Unit content

Identify, select and safely use

Identification, correct selection, application and maintenance of hand tools, fixed and portable power tools, specialist and test, equipment, lifting, supporting and securing devices

Unit 202 Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment

Outcome 2 Know how to select, use and maintain tools and equipment appropriate to the task

Assessment Criteria

The learner can:

1. **Compare tools and equipment** available to undertake relevant tasks
2. Describe the **operational techniques and maintenance** of tools
3. Describe the range of tools for **thread identification and maintenance**
4. Identify the different **power supply requirements** for power tools
5. Describe how to **isolate mains electrical equipment and how to charge portable tool packs**

Range

Tools

Hand, air and electric power tools, fixed and portable equipment, taps and dies, reamers, drill bits, measuring and marking equipment, tools for thread identification and maintenance

Specialist and test equipment

Engine testing, fuel, hydraulic, electrical and temperature, tools for dismantling and reassembling, fabrication, supporting, clamping, compressing, extracting, lifting and slinging

Unit content

Compare

Compare and evaluate the suitability for a given application a range of hand tools, power tools, fixed and portable equipment

Operational techniques and maintenance

Engine testing, fuel test equipment, hydraulic test equipment, electrical test equipment, work securing devices

Thread identification and maintenance

Techniques/methods of thread identification, thread maintenance and reinstatement procedures and tools

Power supply requirement

240 volt, 110 volt, low voltage battery packs, chargers and transformers, Portable Appliance Testing (PAT)

Isolate mains electrical equipment and charge portable tool packs

Location, identification and operation of mains electrical isolation switch gear, emergency stop and isolation switches, identification of and correct usage of portable tool battery pack chargers

Unit 202 Land-based Engineering Operations – Understand How to Use, Service and Maintain Tools and Equipment

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to use service and maintain tools and equipment. At all times an emphasis must be put on safe working practices and the relevant current legislative requirements including first aid, Personal Protective Equipment (PPE), the provision and use of work equipment regulations electrical equipment, lifting and compressed air equipment, abrasive wheels and other legislation as applicable.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of tools and equipment is involved. This unit requires the learner to undertake tools and equipment use and maintenance under close supervision. At all times practical maintenance tasks should be carried out to manufacturers' specifications. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of outcome 1 is likely to be predominantly practically based and learners will need access to a wide range of tools and equipment. It is important that learners are able to identify the tools and equipment required for specific tasks together with their maintenance requirements. Learners should have sufficient supervised opportunity to use tools and equipment for a variety of purposes.

Delivery of outcome 2 requires learners to gain an understanding of the tools and equipment to complete the practical tasks in outcome 1. This also needs to include the range of tools for thread identification and maintenance and power supply requirements. Learners are required to gain an understanding of how and why to isolate mains electrical equipment but are not required to carry this out in practice.

It would be useful to deliver outcome 1 and 2 in conjunction with each other thus allowing the learner to describe the practical they have just carried out.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X
- Hillier V and Coombes P — *Hillier's Fundamentals of Motor Vehicle Technology, 5th Edition* (Nelson Thornes, 2004) ISBN 0748780823
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www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 203

Land-based Engineering Operations – Material Preparation, Shaping and Assembling

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of material preparation, shaping and assembly operations 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.

The aim of this unit is to provide the learner with the knowledge and skills required to perform materials preparation, shaping and fixing.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform material preparation, shaping and assembly operations
2. Know how to carry out material preparation, shaping and assembly operations

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the 029NLEO6.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 203

Land-based Engineering Operations – Material Preparation, Shaping and Assembling

Outcome 1

Be able to perform material preparation, shaping and assembly operations

Assessment Criteria

The learner can:

1. Interpret information in relation to engineering tasks from **engineering drawings, sketches and instructions**
2. **Mark out profiles** to given specifications
3. Produce profiles and **process materials** to given specifications and tolerances
4. **Assemble and verify** components and sub assemblies

Unit content

Engineering drawings sketches and instructions

Engineering drawing symbols and terminology, the interpretation of engineering drawings, sketches and instructions

Mark out profiles

Methods, tooling and techniques used for marking out, engineers blue, templates, jigs, scribes and centre punches, datum lines and squares, permanent and removable marking

Process materials

Hot and cold cutting, filing, grinding, hot and cold bending, checking of component to specification tolerances, finishing to pattern, degrease, de-scale, clean, harden, anneal, temper, polish, protective coatings

Assemble and verify

Methods of mechanical fastening: keys, rivets, pins, dowels, circlips, snap rings, belt joiners, chemical and adhesive fastening

Methods of sealing: compounds, gaskets, rings, face fits, thread tapes and seals

Methods used in assembly, routing and securing pipes and hoses, electrical cables and harnesses, operating cables, marking and timing components, balancing, component protection, fits and tolerances, methods of achieving and checking alignment, special tooling

Unit 203

Land-based Engineering Operations – Material Preparation, Shaping and Assembling

Outcome 2

Know how to carry out material preparation, shaping and assembly operations

Assessment Criteria

The learner can:

1. Describe how to **interpret an engineering drawing**
2. Describe the preparation techniques and tools used for **marking out, cutting, shaping and finishing**
3. Describe **hardware fastener types**, their characteristics and applications
4. Identify the different **materials** and methods used to seal components and assemblies
5. Outline methods and **techniques used to assemble components**

Unit content

Interpret an engineering drawing

Engineering drawing symbols and terminology, the interpretation of engineering drawings, sketches and instructions

Marking out cutting shaping and finishing

Methods, tooling and techniques used for marking out, engineers blue, templates, jigs, scribes and centre punches, datum lines and squares, permanent and removable marking. Hot and cold cutting, filing, grinding, hot and cold bending, checking of component to specification tolerances. Finishing too pattern, degrease, de-scale, clean, harden, anneal, temper, polish, protective coatings

Hardware fastener types

Methods of mechanical fastening: keys, rivets, pins, dowels, circlips, snap rings, belt joiners, chemical and adhesive fastening, cable, pipe and harness fixings

Materials

Compounds, gaskets, rings, face fits, thread tapes, seals

Techniques used to assemble components

Methods used for checking and achieving alignment, routing and securing pipes, hoses, electrical cables, harnesses, and operating cables, marking of orientation and timing of components, balancing components, component protection, fits and tolerances, special tooling, securing components and torque settings

Unit 203 Land-based Engineering Operations – Material Preparation, Shaping and Assembling

Notes for guidance

This unit is designed to provide the learner with the knowledge and understanding of how to prepare materials, mark out, shape and protect materials following engineering instructions, drawings and specifications.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the use of equipment and machinery is involved. This unit requires the learner to undertake materials assembly under close supervision, and this is the same for any unit within the qualification that requires the learner to operate or use machinery. At all times practical tasks should be carried out to manufacturers' specifications.

There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of outcomes 1 and 2 is likely to be closely linked, with practical activity in outcome 1 supported by the underpinning knowledge from outcome 2.

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. The learner will need sufficient opportunity to practice interpreting information for a range of engineering tasks and then using this information to prepare profiles and process materials. Delivery needs to include sufficient time for learners to develop their skills in assembling and verifying components and sub assemblies.

In outcome 2 the learner will gain a knowledge and understanding of the techniques, tools and materials used in a range of engineering tasks. The outcome is mainly theory based, and could be made more interesting and relevant using good examples of different types of materials before and after assembly.

It would be useful to deliver outcome 1 and 2 in conjunction with each other thus allowing the learner to describe the practical they have just carried out.

References

Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 204

Monitor and Maintain Health and Safety in a Land-based Engineering Work Area

Level: 2

Credit value:10

Unit aim

This unit aims to provide learners with an understanding of the principles of health and safety in a land-based engineering work area 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.

The aim and purpose of this unit is to provide the learner with the knowledge and skills to monitor and maintain health and safety within a land based engineering work environment.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to monitor and maintain health and safety within land-based engineering work area
2. Know how to monitor and maintain health and safety within the work area

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit matches LEO1.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge

Unit 204 Monitor and maintain Health and Safety in a land-based engineering work area

Outcome 1 Be able to monitor and maintain health and safety within land-based engineering work area

Assessment Criteria

The learner can:

1. **Work safely, cleanly and tidily** at all times, complying with health and safety and other relevant regulations and guidelines
2. **Carry out main responsibilities of an employee** in relation to health and safety in the workplace
3. Follow procedures to both prevent and deal with hazards and risks in the workplace

Unit content

Work safely, cleanly and tidily

Select and appropriately use, care for and maintain Personal and Protective Equipment provided for use at work

Safely move, raise and support loads manually and with the aid of equipment

Carry out main responsibilities of an employee

Report and record any hazards in-line with the organisations procedures and health and safety best practice

Unit 204 Monitor and maintain Health and Safety in a land-based engineering work area

Outcome 2 Know how to monitor and maintain health and safety within the work area

Assessment Criteria

The learner can:

1. Outline the **responsibilities of an employer and employee** in relation to health and safety in the workplace
2. Describe the **procedures used to prevent and deal with risks and hazards** in the workplace
3. Describe processes, products, activities, tools and equipment that require recognised training and competence to prevent personal injury and harm to others
4. Describe how to **safely move, raise and support loads manually** and with the aid of equipment
5. Identify the different **types of fire extinguishers** found in the workplace and state their application

Unit content

Responsibilities of an employer and employee

The requirements of current health and safety legislation, communication of health and safety matters, reporting health and safety matters, recording health and safety matters, personal health and safety responsibilities

Describe the consequences of unsafe behaviour and practices in the workplace

Describe responsibilities in relation to Personal Protective Equipment (PPE) found in the workplace to include: provision, selection, use, care and maintenance of PPE

Procedures used to prevent and deal with risks and hazards

Fire and / or explosion, dust and airborne particles, fumes & gasses, corrosives, solvents, irritants, electricity, stored energy

Describe the organisations procedures for reporting and recording accidents and incidents

Explain the difference between a hazard and a risk

Describe the actions to be taken in the event of an emergency to minimise personal and third party injury risk covering: shutdown of electricity, the presence of gas cylinders and / or equipment, evacuation procedures, the use of alarms, the use of barriers, the use of warning signs, first aid procedures on site, first aid procedures off site.

Summarise health and safety precautions to be observed in the workplace to avoid risk to a third party.

Describe the appropriate precautions and actions to be taken to prevent and / or avoid health and safety and environmental risks covering: containment and removal of leaks and spillages, cleaning the work area, disposal of waste material, cleaning contaminated equipment, removing fumes, dust, hazardous gasses

Safely move, raise and support loads manually

Lifting, jacking and supporting securing

Types of fire extinguishers

Solid materials, flammable liquids, flammable gasses, electrical

Unit 204 Monitor and maintain Health and Safety in a land-based engineering work area

Notes for guidance

This unit is designed to give the learners the necessary knowledge and skills to understand health and safety requirements in the work place and be able to work to the appropriate legislation and policies which are in place

It is important that learners are closely supervised when working in a workshop environment and follow safe working practices at all times and that risk and hazards are assessed prior to any activity commencing.

The use of company policies and HSE legislation is recommended through out this unit.

The delivery of this unit will be mostly classroom based but visits to workshops would benefit the learners by showing them how health and safety relates to the working environment.

References

Books

Bell, B. 1992. *Farm Workshop*. 2nd ed. Ipswich: Farming Press. ISBN 0852362374
Health and Safety at Work etc Act 1974, The Stationary Office. ISBN 0105437743
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Journals

Profi International
Farmers Weekly
Farm Ideas

Websites

www.hse.gov.uk

Health and Safety Executive

Unit 205

Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of service and maintenance operations on land-based equipment 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to carry out servicing and maintenance operations within land based engineering.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform servicing and maintenance operations on land-based equipment
2. Know how to perform service and maintenance operations in land-based equipment

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO8.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 205 **Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment**

Outcome 1 Be able to perform servicing and maintenance operations on land-based equipment

Assessment Criteria

The learner can:

1. **Prepare equipment** and the working area prior to service and maintenance operations
2. Inspect equipment for **conformity** to manufacturer's specifications and take **remedial actions**
3. Carry out **service operations** in line with manufacturer's schedules and standards
4. Test, clean and reinstate the machine to **operational condition**
5. **Record and process** information

Range

Equipment

Hand held, pedestrian, self propelled, mounted and/or trailed land based machinery

Working Area

Area in the local surroundings of the land based vehicle to be worked on

Unit content

Prepare Equipment

Operational checks, cleaning, protecting the machine against damage, ensuring safety

Conformity

Unauthorised modification, leaks, loose fitments, rubbing and chafing, operational checks, wear, fire hazards guarding

Remedial actions

Repair, replace, re-build broken worn components

Service operations

Follow manufactures' guidelines relevant to the land based machine to ensure it is serviced correctly using parts and lubricants to the correct quality and specification

Operational condition

Full safe working order

Record and process

Service record sheet (manufacturers or own spreadsheet) photos, diagrams, importance of accurate recording, e.g. use of recorded data to plan next service or further servicing needed

Unit 205 Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment

Outcome 2 Know how to perform service and maintenance operations in land-based equipment

Assessment Criteria

The learner can:

1. Outline the **reasons for service and maintenance operations**
2. Describe **routine service and scheduled maintenance actions** to be taken
3. Describe and differentiate between the **different types of filter**, their construction, function and service requirements
4. Describe how to **assess and prepare** machinery prior to service and maintenance operations
5. Describe how to remove, dismantle, repair, reinstate and adjust **service items**
6. Describe the methods used to carry out **compliance tests** on machinery related to the service work that has been performed

Range

Equipment

Hand held, pedestrian, self propelled, mounted and/or trailed land based machinery

Unit content

Reasons for service and maintenance operations

Scheduled service, routine maintenance, safety, breakdowns, contamination, wear, conformity, longevity and residual value

Routine Service and Scheduled maintenance actions

Servicing, component replacement, component rebuilding, safety system check

Daily, weekly, monthly, annually, scheduled operating hours, pre-delivery inspection and installation

Different types of filter

Size (micron), water, centrifugal, fibre (paper, fibreglass etc), plate, foam, cotton gauze, oil bath, high pressure, suction, pre-cleaners, carbon, air, ventilation (cab) filters

Assess and prepare

Selecting, preparing and cleaning the work area, carry out machine operational checks prior to commencing service operations, cleaning the machine prior to commencing work, protecting the machine against damage during service work, making the machine safe prior to commencing work, assessing for unauthorised modification, oil, gas, air, fuel, water leakages, loose or missing fitments, rubbing and chafing, wear, fire hazards, guarding seizure

Service items

Fuel, transmission oil and fluid, brake fluid, coolants, high and low pressure oil filters, high and low pressure fuel filters, ventilation and breather filters, wet and dry air filters, check, change and adjust oil and grease levels, change and clean ignition system components, change wearing/consumable parts, belt tensions, chain tensions, clearances, free play, cables, linkages

Compliance tests

Meeting current safety and performance criteria, acceleration and deceleration, power, pressure, flow, maximum speed, idle speed, engagement and disengagement, starting, performance, leak tests

Unit 205 Land-based Engineering Operations – Carry out Servicing and Maintenance on Land-based Equipment

Notes for guidance

This unit is designed to provide learners with the knowledge, understanding and skills required to carry out service and maintenance operations on land-based equipment.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery maintenance under close supervision. At all times practical maintenance tasks should be carried out to manufacturers' specifications.

There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of outcomes 1 and 2 is likely to be closely linked, with practical activity in outcome 1 supported by the underpinning knowledge from outcome 2.

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. The learner will be taught how to service land based machinery, starting with preparing the working area and equipment. The learner must be provided with correct tools, and a suitable work area to service the machinery safely and efficiently, whilst following the supplied manufacturer's specifications. It is suggested that the learner follows these specifications carefully and the learner is advised of the possible consequences of deviating from these and cutting corners.

The learner will need to have the opportunity to carry out recording of servicing correctly using the manufacturer's record sheet, or by devising their own. Learners will also need to gain an understanding of the importance of accurate recording. A wide range of land based machinery will be required along with the correct service instructions and materials.

In outcome 2, the learner will gain a knowledge and understanding of the reasons and methods in which routine maintenance is carried out on land based machinery. It is important that the learner understands the need for regular maintenance and repair and the recording processes. The outcome is mainly theory based, and could be made more interesting and relevant using good examples of service items, and broken items through lack of service/conformity.

It would be useful to deliver outcome 1 and 2 in conjunction with each other thus allowing the learner to describe the practical they have just carried out.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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www.hse.gov.uk	Health and Safety Executive
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www.iagre.org	Institution of Agricultural Engineers

Unit 206

Understand and Follow Organisational Procedures within Land-based Engineering Establishments

Level: 2

Credit value: 5

Unit aim

The aim of this unit is to provide the learner with the knowledge, and skills required to understand and follow organisational procedures required by the job role. Pre-delivery is not exclusive to new equipment.

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

There are **two** learning outcomes to this unit. The learner will:

1. Be able to follow organisational procedures
2. Know the organisational procedures required by the job role

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO2.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 206

Understand and Follow Organisational Procedures within Land-based Engineering Establishments

Outcome 1

Be able to follow organisational procedures

Assessment Criteria

The learner can:

1. Follow organisational, departmental and task **procedures** required of the job role
2. Complete the following **administration tasks** and record technical information
3. **Prepare and organise** to carry out tasks required by the job role
4. **Locate, access, download**, file and store electronic software and copy technical documentation

Range

Documentation

Job cards, time sheets, parts requisitions, service records, warranty records, technical and parts documentation

Unit content

Follow Procedures

Organisation, departmental and task procedures

Administration Tasks

In line with company/ manufacturers and suppliers requirements, completion of job cards, parts requisitions, service records and warranty records, technical reporting.

Prepare and Organise

Preparation to carry out a work task, work area, vehicle and equipment special tooling, documentation, Health & Safety considerations, Personal Protective Equipment (PPE), Risk Assessment

Locate, access, down-load

Technical data (electronic and hard copy), service histories, diagnostic information, warranty records, service bulletins

Unit 206

Understand and Follow Organisational Procedures within Land-based Engineering Establishments

Outcome 2

Know the organisational procedures required by the job role

Assessment Criteria

The learner can:

1. Describe the **structure of a given land-based organisation**
2. Describe the procurement, storage retail and transport of **parts**
3. Describe how to complete and process **internal and supplier documentation**

Range

Procedures

Pre Delivery Inspection (PDI) and service procedures, warranty procedures

Documentation

Job cards, time sheets, parts requisitions, service records, warranty records, technical documentation

Unit Content

Structure of a land-based organisation

Levels of responsibility and authority, communication channels, organisational procedures, confidentiality, company and management structure, health & safety and environmental policies, efficiency and effectiveness

Parts

Parts procedures, ordering processes, parts location and identification, quality procedures, documentation

Internal and supplier documentation

Timesheets, job cards, parts requisitions, vehicle and unit mileage, engine hours, service records, serial numbers, warranty and quality control

Unit 206

Understand and Follow Organisational Procedures within Land-based Engineering Establishments

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to follow organisational procedures. At all times an emphasis must be placed upon safe working practices and current legislation.

In outcome 1 the learner will be required to follow organisational, departmental and task procedures, record and store organisational and technical information in line with their role within the organisation. This could be delivered through work placement activity or by appropriate simulations within the centre. Learners should be given the opportunity to complete realistic administrative tasks including the use of I.T. Delivery will also need to help learners develop the organisational skills required for a typical role within the sector.

In outcome 2, delivery is likely to be predominately classroom based but could be helpfully supplemented to visits to one or more land-based organisations where learners are able to gain an insight into the organisational structure. The learner will investigate and understand the levels of responsibility and authority within the company roles. The learner should also gain an understanding of all methods of communication and the importance of confidentiality. A visit or guest speaker could help the delivery of documentation processing and parts, ordering and transport.

References

Books

- Brooks, M. 2008. *Organisational Behaviour: Individuals, Groups and Organisation*. 4th ed. New Jersey: Prentice Hall.
- Brown, A. 1998. *Organisational Culture*. 2nd ed. New Jersey: Prentice Hall.
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Unit 207

Provide Customer Care within Land-based Engineering Operations

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of customer care within land-based engineering operations 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to provide customer care to customers using land based engineering services

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to apply customer care principles
2. Know how to apply customer care principles

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the 029NLEO 3.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 207

Provide Customer Care within Land-based Engineering Operations

Outcome 1

Be able to apply customer care principles

Assessment Criteria

The learner can:

1. **Project** the appropriate level of **professionalism**, personal appearance, conduct and behaviour
2. **Communicate information** to customers using appropriate methods
3. **Describe the importance of meeting customer's expectations**
4. Respect customer and corporate **confidentiality**

Range

Customers

Retail customers, colleagues, departments, employers, suppliers

Communication

Oral, visual, electronic, written

Unit content

Professionalism

Personal appearance, dress standards, working environment presentation, behaviour and body language, use of appropriate language, positive, helpful, respectful and confident attitude

Communication

Techniques used in Information gathering, listening and understanding, open and closed questioning, methods used to confirm understanding, methods used to accurately pass, receive and record information, use of clear communication and terminology, recognising barriers to communication, protocols, layout and standards for written and electronic communication

Customer expectations

Reasons for and techniques used to establish and meet customer expectations, acting on findings, confirmation that expectations have been met

Confidentiality

Reasons for and techniques used to protect confidentiality e.g. use of confidential meeting area, secure processing and filing of information

Unit 207

Provide Customer Care within Land-based Engineering Operations

Outcome 2

Know how to apply customer care principles

Assessment Criteria

The learner can:

1. Describe how to **promote a positive image** of yourself, colleagues, the organisation and its products and services
2. Describe how to **communicate** with the customer **politely, respectfully and effectively**
3. Describe how to **recognise different behaviours** in customers
4. State **the limits of your authority and responsibility** when dealing with customers.
5. State the reasons why **customer and corporate confidentiality** must be respected

Range

Customers

Retail customers, colleagues, departments, employers, suppliers

Communication

Oral, visual, electronic, written

Unit content

Promote a positive image

Behaviour, language, personal appearance, recognising positive and negative attitudes, preparation of work activities, presentation of vehicles, equipment and working environment., codes of conduct, taking ownership of a problem and avoiding the blame culture, reasons for creating a positive image

Communicate politely, respectfully and effectively

Importance of effective communication, barriers to communication (body language, familiarity, inappropriate language and behaviour, emotional, environmental and personal factors), methods of addressing the customer, empathy, listening and questioning techniques, clarification of understanding, communication of information at the correct technical level

Recognise different behaviours

Aggressive, assertive and passive customer behaviour, dealing with, abuse (general and personal) threats, complaints, compliments

Limits of authority and responsibility

Technical, financial, warranty, loan and replacement, handling complaints, dealing with other staff, processes to deal with limited areas of authority and responsibility

Customer and corporate confidentiality

Reasons for confidentiality: data protection legislation, protecting business interests, protecting corporate and customer reputation

Techniques used to avoid compromising confidentiality, e.g. use of confidential areas, secure filing and processing of information

Unit 207 Provide Customer Care within Land-based Engineering Operations

Notes for guidance

This unit is designed to provide the learner with an understanding of customer care principles, and the opportunity to develop their own customer care skills and approach.

For outcome 1 it is likely that delivery could include a range of classroom based activities including role play and discussion. It would also be beneficial to visit one or more land-based engineering organisations to witness customer care at first hand. The learner will need the opportunity to practice their own customer care skills, either in a workplace or in a simulated environment. If the latter, it would be helpful if a range of realistic customer care issues are experienced, such as technical queries, complaints and pricing enquiries. It will be important that learners are able to demonstrate an appropriate level of professionalism when dealing with internal and external customers. During formal assessment observation of dress, appearance and conduct will be required, together with the ability to use clear concise communication and recording methods. Learners will also need to develop their skills in the use of questions to clarify customer needs and requirements, and in effective listening. As communication with customers may take place electronically or in writing as well as verbally, it is important that delivery includes a range of situations and the opportunity to compose appropriate responses.

It will be helpful if delivery of outcome 2 is linked to outcome 1. For outcome 2 delivery needs to encompass the range of customer care principles which enable effective customer care to be demonstrated in outcome 1. The learner will investigate how the image of themselves, colleagues, the organisation, its products and services can be enhanced by the application of customer care principles. Delivery needs to cover how to communicate with customers appropriately whilst recognising and dealing with different behaviour types and the actions that are to be taken when faced with unreasonable demands. Learners will also need to gain a clear understanding of the limits of authority and responsibility and how to deal with them in front of the customer, and the importance of confidentiality for both the organisation and the customer. Delivery is likely to include a range of classroom based activities and a guest speaker with experience of customer care in the land-based engineering sector and its importance would add interest and relevance.

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Books

- Brown, A. 1998. 1998. *Organisational Culture*. 2nd ed. New Jersey: Prentice Hall.
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Unit 208

Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of thermal joining and cutting 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.

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

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform thermal joining and cutting
2. Know how to perform thermal joining and cutting techniques

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO9.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 208 Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes

Outcome 1 Be able to perform thermal joining and cutting

Assessment Criteria

The learner can:

1. Identify welding and **thermal joining equipment**
2. Identify **ferrous and non-ferrous materials** and their suitability
3. **Prepare the workplace materials and equipment** to carry out a thermal joining process
4. Use the correct **techniques** to carry out thermal joining tasks
5. **Join** ferrous or non-ferrous **materials** to the required quality and dimensions
6. **Identify faults** in welded, bronze welded and soldered joints
7. Inspect and **maintain equipment and change consumables** used in joining processes
8. Safely **set up and shut down equipment** for oxy-acetylene gas heating, cutting and joining

Range

Equipment – Manual Metal Arc welding (MMA), Oxygen fuelled cutting and welding and soldering

Processes – welding, gas fuelled cutting and soldering

Joint types – butt, lap, fillet, single run, multi run

Unit content

Thermal joining equipment

Identification of MMA and oxygen fuelled cutting, welding and soldering equipment and their component parts and applications. Personal Protective Equipment (PPE), its application and care. The safe working practices, handling, storage and installation of pressurised gas cylinders. Identification of gas cylinders

Ferrous and non ferrous materials

Identification of materials and their properties/suitability for welding, bronze welding, cutting and soldering

Prepare the workplace, materials and equipment

Check that the work area is free of personal and bystander hazards, check equipment is safe and serviceable prior to use, setting of process parameters and selection of electrode is correct for the given MMA joint, selection of oxy fuel gas pressures, nozzles sizes and filler rod sizes appropriate for the thermal joining and cutting process to be undertaken, selection of preparation processes and setting up of joints for welding cutting and soldering operations, preparation of joints prior to welding and soldering activities

Join materials

Production of oxy fuelled and MMA welded and soldered joints in low carbon steel within the range of material thickness and correct dimensions. Selection of fluxes for gas bronze welding and soldering

Identify faults

Techniques used to identify faults in thermal joining and cutting processes to include visual inspection, non destruction and destruction testing, faults caused through contamination of materials, lack of /excessive penetration, undercutting, incorrect preparation/process, incorrect settings, oxidation and carbonisation, slag traps, cracking and porosity in thermal joining and cutting processes

Inspect and maintain equipment and consumables

Inspection and maintenance procedures for MMA, oxy fuelled thermal and cutting equipment and thermal joining PPE, storage requirements for welding consumables, identification of faulty welding consumables, cleaning procedures for welding and cutting nozzles, changing of gas cylinders, reporting of faulty equipment

Set up and shut down equipment

Safe working practices when setting up and closing down thermal joining and cutting equipment, procedures to close down and safely store equipment on completion of use

Unit 208

Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes

Outcome 2

Know how to perform thermal joining and cutting techniques

Assessment Criteria

The learner can:

1. Describe how to **identify** ferrous and non ferrous **materials and their** respective **joining characteristics**
2. Describe the **material preparation and joining procedures**
3. Describe the techniques for joining ferrous and non-ferrous materials using **gas and electric welding and soldering methods**
4. Describe how to **select, prepare and set** the relevant **equipment** to carry out welding and joining tasks
5. Describe how to **detect and** correctly **identify faults** and their causes in welded joints
6. Describe the **precautions** required when engaging in a thermal joining and cutting process
7. Describe how to safely **set up equipment** and use the correct techniques **for oxy-acetylene gas heating, cutting and joining**

Range

Equipment – Manual Metal Arc welding (MMA), Oxygen fuelled cutting and welding and soldering

Processes – welding, gas fuelled cutting and soldering

Joint types – butt, lap, fillet, single run, multi run

Unit content

Identify materials and their joining characteristics

The methods of identify ferrous and non ferrous materials their properties and joining / oxy fuelled cutting characteristics when used in similar and dissimilar sizes

Material preparation and joining procedures

Process required to prepare, butt, lap, fillet, single run, multi run joints for thermal joining and the consideration required when joining similar and dissimilar material thicknesses and types

Gas and electric welding and soldering methods

Techniques used in the thermal joining and oxy fuel cutting processes, limited to the horizontal plane and vertical down hand technique. Methods used to carryout tacking, positioning, control of distortion and the effects of heat

Select prepare and set up equipment

Preparation and set up of equipment is to include the setting of oxy fuelled flames, pressures, amperages, voltages, selection of electrodes and filler rods, nozzle sizes selection of fluxes for bronze welding and soldering. The properties and purpose of fluxes the removal of slag and safe disposal of excessive flux deposits with regard to health and the environment

Detect and identify faults

To include visual inspection, non destruction and destruction testing, faults through contamination of materials, lack of/excessive penetration, undercutting, incorrect preparation/process, incorrect settings, oxidation and carbonisation, slag traps, spatter, cracking and porosity in thermal joining and cutting processes, how to identify and rectify the cause of weld defects

Precautions

To include fumes, explosions, fire, sharp edges, airborne debris and person and bystander injury

Set up equipment

Select and clean nozzles and soldering equipment, identification of gas cylinders and hoses by colour and screw thread size, methods of assembling, cracking/purging and leak testing gas cylinders, setting of regulators, gas pressures and flame settings for oxy-fuel thermal joining and cutting

Unit 208

Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes

Notes for guidance

This Unit does not cover the repair of safety critical components.

This unit is mainly practically based and is designed to provide learners with the knowledge and skills to carry out the Manual Metal Arc (MMA) welding, Oxy-Fuel welding, soldering and gas cutting processes.

Centres and tutors need to be aware of the need to safeguard learners when delivering and assessing units where the operation of equipment and machinery is involved. This unit requires the learner to undertake thermal joining and cutting operations under close supervision, and this is the same for any unit within the qualification that requires the learner to operate or use machinery. There is significant emphasis on safe practices throughout the unit. Throughout the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout.

During the delivery of this unit learners will need the opportunity to develop their skills to produce a range of welded joints and Oxy-Fuel gas cuts. The learner will also be expected to work within the relevant industrial standards. Learners will develop theoretical and practical skills in the safe working practices associated with welding and cutting processes including the use of explosive gases.

In Outcomes 1 and 2 learners should develop a sound knowledge of health and safety good practice and the legislation regulating the use and storage of bottled gas.

Performance evidence supplemented by observation checklists is required to demonstrate that the learner has safely carried out a soldered joint, brazing, oxy-fuel welding, manual metal arc and Oxy-fuel cutting to a satisfactory standard.

References

Books

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www.iagre.org	Institution of Agricultural Engineers

Unit 209

Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing cooling and lubrication 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.

The aim of this unit is to provide the learner with the knowledge and skills required when working with cooling and lubrication systems within land based engineering

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on cooling and lubrication systems
2. Know the construction and function of cooling and Lubrication systems, their components

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the O29NLEO10.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 209

Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems

Outcome 1

Be able to perform service and repair operations on cooling and lubrication systems

Assessment Criteria

The learner can:

1. Identify different types of **cooling and lubrication systems** and their components
2. Identify the different types of **coolants and lubricants** and select the appropriate product to comply with **manufacturers specifications**
3. Perform operations requiring the **drainage and replacement of lubricants and coolants**
4. Prepare and **test cooling and lubrication systems and their components**

Unit content

Cooling and lubrication systems

Air, air/fluid, fluid/fluid cooling, oil/fuel mixture, splash, pressure lubrication

Coolants and lubricants

Coolant dilution, types, and reasons for use, lubricant specification (ACEA, API ratings), lubricant viscosity

Manufacturers specifications

Operator's manual, workshop manual, taking samples, checking levels, flushing

Drainage and replacement of lubricants and coolants

Personal Protective Equipment (PPE), safe and legal disposal, storage, risk assessments

Test cooling and lubrication systems and their components

Pressure, temperature, sensory and leak tests

Unit 209 Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems

Outcome 2 Know the construction and function of cooling and Lubrication systems, their components and the coolants and lubricants used

Assessment Criteria

The learner can:

1. State the **reasons** and **methods** of the control of temperature in land-based engineering applications
2. Describe the **causes** and **symptoms of insufficient cooling and lubrication**
3. Describe the **fundamental operating principles of lubrication and cooling systems in engines**
4. State the **reasons for lubrication and cooling systems in engines**
5. Describe how to dismantle, repair and reinstate **cooling and lubrication systems**

Unit content

Reasons

Expansion, contraction, vaporisation, efficiency, combustion, friction, emissions

Methods

Liquid, forced air, convection/conduction, radiation, heat sinks, insulation materials

Causes

Obstruction, circulation, air locks, ambient temperature, system pressure overload, lack of coolant, overloading

Symptoms of insufficient cooling and lubrication

Distortion, glazing, wear, seizure, hot spots, friction welding, scoring, cavitation, warping

Fundamental operating principles of lubrication and cooling systems in engines

Wet/dry sump, drip, gravity, immersion, splash, fuel/lubricant mixture, self lubrication, pressure fed, automatic greasing, filtration, air cooled, liquid cooled

Reasons for lubrication and cooling systems in engines

Friction, wear, reducing operating temp, particulate suspension

Cooling and lubrication systems

Sensory, pressure, input and output temperatures, leak, thermostats, fan speeds, flushing and bleeding procedures

Unit 209

Land-based Engineering Operations – Service and Repair Cooling and Lubrication Systems

Notes for guidance

This unit provides the learner with knowledge and skills required to service, and repair faults on cooling and lubrication systems on land-based machinery. The construction, and function of these cooling and lubrication systems components, and the makeup of coolants and lubricants is also covered. It is important that more than land-based cooling and lubrication is covered. At all times when practical tasks are carried out or assessed, an emphasis must be put on safe working practices and current legislation.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery maintenance under close supervision. At all times practical maintenance tasks should be carried out to manufacturers' specifications. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. The learner will be required to identify types of cooling and lubrication components, systems and types of coolant, lubrication, including specifications.

Delivery should include the importance of storage and disposal of new and used coolant and lubricants to conform to legislation and suppliers' specification.

In outcome 2, the learner will be required to investigate the reasons and methods of control of temperature, and the results from insufficient cooling and lubrication in land-based machinery. Dismantling, repair and reinstatement of cooling and lubrication systems must also be covered. The fundamental operation of cooling and lubrication systems in land-based engines also needs to be covered including a range of land-based engines, with the reasons why they are used.

This outcome can be delivered using classroom based activities, but would benefit from practical demonstrations, and the use of examples of good, worn and broken components.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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www.iagre.org	Institution of Agricultural Engineers

Unit 210

Land-based Engineering Operations – Service and Repair Engines and Components

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing engines and components 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.

The aim of this unit is to provide the learner with the knowledge and skills required to perform engine service and repair tasks on land based engineering equipment

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform basic service and repair procedures on engines and their components
2. Know the construction, function and operation of two stroke, four stroke spark and compression ignition engines and their components

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO11.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 210 **Land-based Engineering Operations – Service and Repair Engines and Components**

Outcome 1 Be able to perform basic service and repair procedures on engines and their components

Assessment Criteria

The learner can:

1. **Identify engine types and their components**
2. **Remove dismantle, repair and reinstate** ancillary engine components and sub-assemblies to manufacturers' specifications and standards

Range

Engine types

S I (Spark ignition) and C I (Compression Ignition) engines (four stroke and two stroke) (air and water cooled)

Components

Fuel delivery pumps, fuel injection, spark ignition and carburettors systems, governors, cold start aids, air filtration and exhaust systems, turbo and super chargers. Cylinder head and valve train assemblies, piston and ring assemblies, liners and cylinder blocks

Unit content

Identify engine types and components

Spark ignition and compression ignition engines and their component parts in mono and multi cylinder format, direct and indirect injection, wet and dry liner construction, normally aspirated and turbo/super charged

Remove dismantle, repair and reinstate

Ancillary engine parts, cylinder head and valve assemblies, piston and liner assembly, crankshaft bearings, fuel, oil and air filters, engine oil and water pump. The methods of sealing pressurised joints (gaskets, seals, jointing compounds), cleaning and marking the position/orientation of components

Unit 210 Land-based Engineering Operations – Service and Repair Engines and Components

Outcome 2 Know the construction, function and operation of two stroke, four stroke spark and compression ignition engines and their components

Assessment Criteria

The learner can:

1. Describe the **types, construction and operating principles of land-based engines**
2. Describe the **function and types of the engine components**
3. Describe engine **features** and their purpose within the engine construction
4. Describe how to **remove, dismantle, repair and reinstate** engines and components to manufacturers specifications and standards (excluding fuel, induction and exhaust systems)
5. Describe **engine starting and stopping procedures**
6. State the major **differences between direct and indirect fuel injection systems**

Range

Engine types and components

S I (Spark ignition) and C I (compression ignition) engines (four stroke and two stroke) (air and water cooled) (naturally and pressure charged)

Components

Fuel delivery pumps, fuel injection, spark ignition and carburettors systems, governors, cold start aids, air filtration and exhaust systems, turbo and super chargers. Cylinder head and valve train assemblies, piston and ring assemblies, liners and cylinder blocks

Unit content

Types construction and operating principles of land based engines

S I (Spark ignition) and CI (Compression Ignition) engines (four stroke and two stroke (inline, inclined horizontal and vee construction)

Function and types of engine components

Injectors, injection and fuel delivery pumps, turbo and pressure chargers, spark ignition systems and spark plugs, carburettors, governors, oil pumps and lubrication systems, water pumps and cooling systems, cold start aids, oil, air and fuel filtration systems, exhaust systems

Features

Engine features (air and water cooled) (wet and dry liners) (mono-block and multi cylinder configurations) (naturally aspirated and pressure charged) (balancers and vibration dampers)

Remove, dismantle repair and reinstate

Methods of removal, marking orientation/positioning, cleaning, removal of contaminants, aligning, timing, sealing, reinstating and setting engine components to manufacturers specifications and standards

Engine starting and stopping procedures

Starting procedure in cold weather (diesel engines), starting procedure in cold weather (spark ignition engines), hot start procedure diesel engine, hot start procedure spark ignition engines, starting procedure for turbo charged engines, stopping procedure for turbo charged engines, actions to be taken before starting and stopping an engine

Differences between direct and indirect fuel injection systems

Economy, design, performance, emissions and starting characteristics

Unit 210 Land-based Engineering Operations – Service and Repair Engines and Components

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding to undertake the service and basic repair of engines and their components under supervision. The learner will be able to select the appropriate service tools to aid removal and replacement of engine components and make mechanical settings and adjustments to components in line with manufacturer's specifications and standards.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of machinery is involved. This unit requires the learner to undertake machinery maintenance under close supervision. At all times practical maintenance tasks should be carried out to manufacturers' specifications. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In Outcome 1, the learner will be required to identify engine types, their component parts, sub assemblies, features and operational function and carry out practical engine service and maintenance operations to manufacturer's specifications and standards. Delivery of this outcome needs to give the learner the opportunity to remove, dismantle, repair and reinstate engines, their components and sub assemblies. The delivery is not required to include components requiring specialist knowledge and equipment, e.g. injection pump, decarbonising cylinder heads, grinding in engine valves, testing injectors and removing components. It is important that the learner is provided the appropriate specialist tools, observes safe working practices and uses the correct PPE. It is recommended that this outcome is delivered using a mixture of classroom teaching and practical based teaching. The learners may benefit from a variety of visiting speakers from the industry.

In Outcome 2, the learner will be able to identify and describe engine and component types and their function and features. The learner will be able to describe the methods used in removing, dismantling, repairing and replacing components and sub assemblies. The learner will also investigate the methods of cleaning components and the removal of contaminants and why components need timing, alignment and setting and how these can be achieved. The learner must gain an understanding of the components that need to be marked for orientation and positioning and how the marking can be applied, and also the different types, materials and methods used to seal high and low pressure engine joints.

It is recommended that this outcome is delivered using mostly classroom based teaching, however the learner will benefit from practical sessions where they can see the machinery and equipment.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X
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www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 211

Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing clutches and associated devices on land-based equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required to service and repair clutches, flywheels and torque converters within land based equipment.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on clutches and associated devices
2. Know the construction, function and operation of clutches and associated devices

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NELO12

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 211 **Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment**

Outcome 1 Be able to perform service and repair operations on clutches and associated devices

Assessment Criteria

The learner can:

1. Carry out **stall tests** and assess the slip point of torque limiting clutches
2. **Remove, dismantle, repair, and reinstate** clutches and associated devices to manufacturer's specifications and standards
3. Identify and **report reasons for** clutch, fluid flywheel and torque convertor **failure**

Range

Clutch types

Torque limiting and slip clutches, dry plate single and dual clutches, wet single and multi disc, fluid flywheels and torque convertors, centrifugal clutches, overrun and dog clutches, electro magnetic clutches, cone clutches

Actuation

Electric, hydraulic, mechanical, centrifugal force, torque

Unit content

Stall tests

Determine which clutch and associated devices types are suitable to apply stall testing, the reasons for and techniques/precautions to be used when carrying out stall testing, interpreting a stall test result, the use of sensory perception and determining a repair solution

Remove, dismantle, repair, and reinstate

Accessing clutches and associated devices to facilitate repair, safe removal of components held under pressure, measurement of components to assess serviceability within manufacturer's specifications and standards for example wear limits, clamp pressures, run out, conformity, alignment and balance, techniques used to mark component orientation and position, procedures used to set clutches and torque limiting devices to manufacturer's specifications, the application of special tooling used in a clutch and associated device repair

Report reasons for failure

Identification of the causes, symptoms and results of slippage in clutches and associated devices, for example abuse, incorrect adjustment, overload, overheat, distortion, wear and tear, sticking/corrosion, contamination, glazing, material and component defect, loss of fluid

Techniques used to observe and formulate an opinion on the cause of failure and compile a report

Unit 211

Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment

Outcome 2

Know the construction, function and operation of clutches and associated devices

Assessment Criteria

The learner can:

1. Describe the different types, **construction, and functions** of clutches, fluid flywheels and torque convertors
2. Explain the methods used to **sequence clutch engagement** and provide smooth drive take up
3. Explain how to remove, **dismantle, repair, recondition and reinstate clutches**, fluid flywheels and torque convertors
4. Describe how to **assess clutch failure, wear and condition**
5. Identify the common **causes and symptoms of clutch, fluid flywheel and torque converter failure**

Range

Clutch types

Torque limiting and slip clutches, dry plate single and dual clutches, wet single and multi disc, fluid flywheels and torque convertors, centrifugal clutches, overrun and dog clutches, electro magnetic clutches, cone clutches

Actuation

Electric, hydraulic, mechanical, centrifugal force, torque

Unit content

Construction and functions

The construction, function and application of 5 of the following devices and their component parts: Torque limiting/slip clutches, dry single and dual plate clutches, wet single and multi plate clutches, fluid flywheels and torque convertors

Centrifugal clutches, and dog clutches, electro magnetic clutches, cone clutches, vibration damping devices

Sequence clutch engagement

The reasons for and methods used to obtain sequencing of clutch engagement for example mechanical, electro hydraulic, clutch plate and damper design plate

Dismantle, repair, recondition and reinstate clutches

Accessing clutches and associated devices to facilitate repair, safe removal of components held under pressure, measurement of components to assess serviceability within manufacturer's specifications and standards for example wear limits, clamp pressures, run out, conformity, alignment and balance, techniques used to mark component orientation and position, procedures used to set clutches and torque limiting devices to manufacturer's specifications, the application of special tooling used in a clutch and associated device repair

Assess clutch failure, wear and condition

The testing procedures and methods to assess clutch wear for example stall tests, slipping torque measurements, component measurement, and sensory inspection, use of equipment to measure run out, wear limits, torque slip points and the units used to express torque and clamp pressure

Causes and symptoms of clutch, fluid flywheel and torque converter failure

Abuse, incorrect adjustment, overload, overheat, distortion, wear and tear, sticking / corrosion, contamination, glazing, material and component defect, loss of fluid

Techniques used to formulate an opinion on the cause of failure, observation / inspection, measurement interpretation of heat markings and wear patterns

Unit 211 Service and Repair Clutches, Fluid Flywheels and Torque Convertors on Land-based Equipment

Notes for guidance

This unit is designed to provide the learner with sound knowledge and skills relating to the construction, function, repair and transmission of drive through clutches and related devices. The unit covers a wide range of devices and allows selection to suit the appropriate area of land based engineering pursued by the learner.

Throughout the unit the learner will be expected to use a range of precision measuring equipment which will include, Dial Test Indicator (DTI), vernier callipers, and torque measuring equipment. Appropriate PPE equipment must be employed and safety working practices exercised when working with stored energy within clutch units and heated fluids within fluid flywheels.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment is involved. This unit requires the learner to undertake equipment maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1, delivery is likely to be largely practical in nature, including supervised practical activities and demonstrations. Learners will need sufficient practical time to carry out tests to ascertain the condition of clutches and related devices, identify the reasons for clutch failure and report their findings. The learner will need practical opportunities to remove, dismantle, repair and reinstate clutches and associated devices using specialist tooling and measuring equipment as appropriate. Whilst some formal learning is necessary it is anticipated that the assessment of this outcome will be based largely on practical applications.

In outcome 2 delivery will enable the learner to identify clutch and associate devices, their functions, operating principles and applications, the process necessary to access, dismantle and repair clutch and associated devices. The learner will be required to access component wear and establish if this is within manufacturer's standards and recognise the symptoms and results of clutch and associated device failures. Delivery is likely to include a range of classroom based activities, supported by practical demonstrations and linked closely with outcome 1.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X
- Hillier V and Coombes P — *Hillier's Fundamentals of Motor Vehicle Technology, 5th Edition* (Nelson Thornes, 2004) ISBN 0748780823
- Whipp J and Brooks R — *Transmission, Chassis and Related Systems (Vehicle Maintenance & Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
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www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 212

Service and Repair Mechanical Transmissions on Land-based Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing operations on mechanical transmissions 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.

The aim of this unit is to provide the learner with the knowledge and skills required to service and repair mechanical transmission in land based equipment

Learning outcomes

There are **four** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on mechanical transmissions
2. Know the type and characteristics of transmission and gearboxes
3. Know how to remove and reinstate transmission
4. Know how to identify transmission faults

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO13.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SCC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 212 Service and Repair Mechanical Transmissions on Land-based Equipment

Outcome 1 Be able to perform service and repair operations on mechanical transmissions

Assessment Criteria

The learner can:

1. Remove dismantle, repair and reinstate **transmission assemblies** and their **components** to manufacturers specifications and standards
2. Identify and report **faults** in mechanical transmission assemblies and their components

Unit content

Transmissions

Mechanical transmissions single and multi ratio, front and rear axle, belt drive assemblies, friction drive assemblies, drive shaft assemblies and PTO drives

Transmission Assemblies

Gearbox, differential, transaxles, final drives, four wheel drive axles, power take off shafts

Components

Clutches, gears, drive shafts, belts, pulleys, chains, sprockets, differential lock, limited slip differentials

Faults

Regular and irregular noise, lock up, loss of drive, drag, overheating, vibration, jump out non selection

Unit 212 Service and Repair Mechanical Transmissions on Land-based Equipment

Outcome 2 Know the type and characteristics of transmission and gearboxes

Assessment Criteria

The learner can:

1. Describe the types, **construction**, characteristics and **operating principles** of **transmissions** and gearboxes
2. Describe the **drive path** through a mechanical transmission and their components with the aid of the manufacturer's schematic drawings
3. Summarise the relationship between **power**, **speed** and **torque** and the influence on transmission layout and component size

Unit content

Transmissions

Mechanical - single and multi ratio, front and rear axle, belt drive assemblies, friction drive assemblies, drive shaft assemblies and PTO drives

Assemblies - Gearbox, differential, transaxles, final drives, four wheel drive axles, power take off shafts

Components

Clutches, gears, drive shafts, belts, pulleys, chains, sprockets, differential lock, limited slip differentials

Construction

Sliding mesh, constant mesh, synchromesh, selectors and interlocks, differentials, differential locks, limited slip, range and reduction, front and / or rear drive axles and their reduction units, forward and reverse shuttle, PTO drives, drive shaft assemblies, constant velocity joints, belt drive assemblies, friction drives, single and multi ratio transmission

Operating principles

The principles by which the drive is transmitted and how the components interact with each other to transmit the drive

Drive paths

The route the drive takes through the transmission system and its components from the point of entry up to its point of exit

Power, speed and torque

Power created by the power unit (horsepower, kilowatts), speed at which the vehicle moves kph, rotational speed of components (rpm), torque: the forces set up in the components when being driven, relationship between power, speed and torque

Unit 212 Service and Repair Mechanical Transmissions on Land-based Equipment

Outcome 3 Know how to remove and reinstate transmission

Assessment Criteria

The learner can:

1. Describe how to remove, dismantle, repair and reinstate **transmissions** and their **components**

Range

Transmission Assemblies

Gearbox, differential, transaxles, final drives, four wheel drive axles, power take off shafts

Unit content

Transmissions

Mechanical transmissions single and multi ratio, front and rear axle, belt drive assemblies, friction drive assemblies, drive shaft assemblies and PTO drives

Components

Clutches, gears, drive shafts, belts, pulleys, chains, sprockets, differential lock, limited slip differentials

Unit 212

Service and Repair Mechanical Transmissions on Land-based Equipment

Outcome 4

Know how to identify transmission faults

Assessment Criteria

The learner can:

1. Explain how to identify land-based equipment mechanical **transmission faults**

Range

Transmissions

Mechanical transmissions single and multi ratio, front and rear axle, belt drive assemblies, friction drive assemblies, drive shaft assemblies and PTO drives

Transmission Assemblies

Gearbox, differential, transaxles, final drives, four wheel drive axles, power take off shafts

Components

Clutches, gears, drive shafts, belts, pulleys, chains, sprockets, differential lock, limited slip differentials

Unit content

Transmission faults

Regular and irregular noise, lock up, loss of drive, drag, overheating, vibration, jump out non selection
Identify by operation and sensory means

Unit 212 Service and Repair Mechanical Transmissions on Land-based Equipment

Notes for guidance

This unit is designed to provide the learner with a sound knowledge and the necessary skills to be able to service and repair mechanical transmissions systems in an appropriate work context.

Throughout the unit the emphasis must be on safe working practices. The learner will be expected to work within recognised industry standards and be familiar with the requirements of risk assessments required for the tasks undertaken. This will include the use of service manuals as appropriate.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment is involved. This unit requires the learner to undertake equipment maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of this unit is likely to include a range of classroom based sessions, workshop practical sessions, and links to work experience where appropriate. The use of visiting speakers may also be considered.

In outcome 1 the learner will gain the skills to service and perform repair operations on a variety of mechanical transmissions. Delivery should include as wide a range as possible, but for assessment the learner will be able to carry out the removal dismantling, repair and reassembly of the following transmission systems: single and multi ratio, front or rear axle, belt drive assemblies, friction drive assemblies, drive shaft assemblies and PTO drives. The learner will also need sufficient supervised practical experience to identify faults in mechanical transmission assemblies and their components. This aspect of the outcome will link closely to the underpinning knowledge gained in outcome 4.

In outcome 2 delivery is likely to include a mix of classroom based activity supplemented by workshop activities and demonstrations. The learner will investigate the types, construction, characteristics and operating principles of mechanical transmission systems and their components, as identified in the unit range. The learner will need to know how to describe the drive path through mechanical transmission system and its components with the aid of manufacturer's drawings and diagrams as appropriate. Delivery also needs to include the relationship between, power, speed & torque and the influence on the transmission layout and size. Case study examples and exercises could help with delivery of this aspect of the outcome.

In outcome 3, the learner will gain knowledge of how to remove, dismantle, repair and reinstate transmissions and their components to manufacturer's specifications using known standards and manufacturer's workshop manuals. This links closely to the practical activities in outcome 1, and it would add relevance and context for delivery of the two outcomes to be linked.

In outcome 4, delivery needs to encompass recognition and explanation of a range of faults in mechanical transmission systems. Learners should be taught to use a variety of techniques including sensory, questioning of the user and operation of the system as far as possible.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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www.iagre.org	Institution of Agricultural Engineers

Unit 213

Service and Repair Braking Systems on Land-based Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing braking systems and their components on land-based equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required in order to service and repair braking systems on land-based equipment.

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on braking systems and their components
2. Know the construction, function and operation of braking systems
3. Know how to recognise the faults in braking systems

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO14.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 213 Service and Repair Braking Systems on Land-based Equipment

Outcome 1 Be able to perform service and repair operations on braking systems and their components

Assessment Criteria

The learner can:

1. Identify **braking systems** and their **components**
2. Perform **tests**, decontaminate, **remove, dismantle, repair and reinstate braking systems** to meet manufacturers/technical and legislative compliance
3. Identify and report braking system **faults**

Range

Mechanical and hydraulic braking systems: band, disk and drum

Unit content

Braking systems

Braking systems: Mechanical and hydraulic

Components

Disc, drum, band, pad, shoe (leading and trailing) cylinder, adjustor, hydraulic and manual actuators, backing plate, bleed nipple

Tests

Visual test, road test, brake efficiency test

Remove, dismantle, repair and reinstate braking systems

For Drum, Disc and Band brakes remove and disassemble to base units, inspect for faults, repair and rebuild the units

Faults

Uneven braking, spongy or soft pedal, pitting, scoring and excessive wear, contamination, binding, grabbing, glazing, fade, failure, vapour lock, vibration, noise, incorrect fluids, leaks

Unit 213 Service and Repair Braking Systems on Land-based Equipment

Outcome 2 Know the construction, function and operation of braking systems

Assessment Criteria

The learner can:

1. Describe the **construction and function of braking systems and their components**
2. Describe how to **remove, dismantle, repair and reinstate braking systems** and their components
3. Describe the **effects that heat can have on braking efficiency and brake components**
4. Summarise the **effects of incorrect braking relationships between towing vehicle and attachments**

Range

Mechanical and hydraulic braking systems: band, disk and drum

Unit content

Construction and function of braking systems and their functions

What materials the brake units (drum disc and band) are made of, how they are operated, and how they break land based vehicles

Remove, dismantle, repair and reinstate braking systems

Adjust, bleed, balance, test, disposal of waste, risk assessment, Personal Protective Equipment (PPE)

Effects that heat can have on braking efficiency and brake components

Glazing, brake fade, wear, deterioration of braking surfaces, vapour lock, degradation of fluids

Effects of incorrect braking relationships between towing vehicle and attachments

Fail safe devices, jack-knifing, and machine damage (internal and external)

Unit 213 Service and Repair Braking Systems on Land-based Equipment

Outcome 3 Know how to recognise faults in braking systems

Assessment Criteria

The learner can:

1. Describe how to recognise **faults** in braking systems

Range

Mechanical and hydraulic braking systems: band, disk and drum

Unit content

Faults

Uneven braking, spongy or soft pedal, pitting, scoring and excessive wear, contamination, binding, grabbing, glazing, fade, failure, vapour lock, vibration, noise, incorrect fluids, leaks

Unit 213 Service and Repair Braking Systems on Land-based Equipment

Notes for guidance

This unit is designed to provide learners with knowledge and understanding of how to service and repair the braking systems of land-based power units, gain an understanding of the construction, function and operation of these systems, and recognise faults. At all times when practical tasks are carried out or assessed, an emphasis must be put on safe working practices and current legislation. All maintenance must follow manufacturers' guidelines, found in service and operator manuals.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of machinery is involved. This unit requires the learner to undertake machinery maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of outcomes 1, 2 and 3 is likely to be closely linked; with practical activity in outcome 1 supported by the underpinning knowledge from outcomes 2 and 3.

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in testing, dismantling, cleaning, repairing and reinstating braking systems, making sure to comply with manufacturers' specifications and current legislation. Delivery also needs to include identification of braking system types and components, and recognition of braking faults and failures.

For outcome 2, delivery is likely to include a mixture of classroom based activities, together with practical sessions to reinforce the knowledge and understanding gained. Learners need to gain knowledge of the construction, and function of braking systems, and components. This will involve learning how to dismantle, clean, repair and reinstate braking systems and components, whilst identifying any effects that heat can have on braking components and efficiency. Learners also need to gain an understanding of how incorrect adjustment of braking systems and components can effect and stability of vehicles, and their overall performance, the damage that can be caused by incorrect adjustment, and which devices are available to prevent this.

For outcome 3, the learner will be taught how to recognise faults in braking systems, including those arising from mis-adjustment, incorrect repair contamination, and seizure/corrosion. This outcome is closely linked with the practical element in outcome 1, where learners need to be able to put this knowledge into practice. Delivery is likely to include classroom and workshop demonstration sessions, as well as linking to the supervised practical activity in learning outcome 1.

All three of these outcomes may involve the learner coming into contact with high temperatures and harmful dust fluids and fumes. It is therefore particularly important that the correct PPE must be worn, and for the tutor to be aware of any materials used covered by COSHH. Any practical activity must be covered by a full risk assessment, preferably done by tutor, and learner, allowing the learner to understand the risks involved.

References

Books

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Manufacturers publications and manuals

Journals

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Websites

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www.defra.gov.uk	Dept for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 214

Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing wheeled and tracked steering systems on land-based equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required to work with wheeled and tracked steering systems on land based equipment

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. Be able to perform service operations on wheeled or tracked steering systems
2. Know the construction, function and operation of wheeled and tracked steering systems
3. Know the symptoms and causes of steering faults

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO15.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 214 Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment

Outcome 1 Be able to perform service operations on wheeled or tracked steering systems

Assessment Criteria

The learner can:

1. Remove dismantle, reassemble, and reinstate steering systems to meet manufacturer's /technical/legislative compliance
2. Using appropriate **tools and equipment**, check and set **steering geometry**
3. Identify and rectify the cause of steering **faults**

Unit content

Tools and equipment

Wheel tracking equipment, straight edge and measuring equipment, protractor

Steering geometry

Toe in/out, camber, caster, king pin inclination, steering lock

Faults

Tyre wear, excessive free movement, incorrect geometry, incorrect track tension, erratic steering

Unit 214 Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment

Outcome 2 Know the construction, function and operation of wheeled and tracked steering systems

Assessment Criteria

The learner can:

1. Describe the **working principles** of mechanical, power assisted and hydrostatic steering systems and their application
2. Describe the types, construction and function of steering **system components**
3. Describe the **principles** and geometry of steering systems
4. Describe how to **remove, dismantle, reassemble and replace** steering system components
5. State the methods of checking and adjusting **steering geometry**
6. Identify the basic mechanical **operating principles of** auto steer and guidance systems used in land-based equipment

Unit content

Working principles

Front and rear axle, crab, pivot, slew, skid, zero turn steering, centre pivot

System components

Steering box, rack and pinion, steering linkages, brake steering, epicyclical steering

Principles

Ackermann, caster and camber angles, king pin inclination, toe in/out, 2 wheel steer, 4 wheel steer

Remove, dismantle, reassemble and replace

Manufacturer's specification and standards, use of appropriate tools and equipment, implications of Control of Substances Hazardous to Health Regulations (2002) (COSHH), Health and Safety at Work etc Act (1974), risk assessment

Steering geometry

Toe in/out, camber, caster, king pin inclination, steering lock

Operating principles of auto steer and guidance systems

GPS signal, Correction signal, RTK, accuracy, indicated guidance, GPS Steering (integrated and bolt on)

Unit 214 Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment

Outcome 3 Know the symptoms and causes of steering faults

Assessment Criteria

The learner can:

1. Describe the **symptoms, characteristics and causes of common steering system faults**

Unit content

Symptoms, characteristics and causes

Steering pull, wheel wobble/shake, lazy/sluggish steering, heavy steering, steering wheel free play, incorrect tyre pressure and sizes, non responsive steering

Common steering system faults

Steering wheel shake, wheel wobble, heavy/sluggish steering, steering wheel free play, steering pull, loss of steering, incorrect tyre pressures, overload

Unit 214 Service and Repair Wheeled and Tracked Steering Systems on Land-based Equipment

Notes for guidance

This unit is designed to provide learners with knowledge and understanding of the working principles of Land Based Vehicle steering systems, both tracked and wheeled. It will enable the learners to develop skills and knowledge in fault rectification and steering systems maintenance, ensuring the systems are compliant to manufacturer's specifications. At all times when practical tasks are carried out or assessed an emphasis must be placed on safe working practices and current legislation.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake machinery maintenance under close supervision. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. The learner will be taught how to identify and rectify steering faults, using appropriate tools, check and set up steering geometry, ensuring all comply with manufacturer's specification, and legislation. It will be beneficial if practical delivery of this outcome is closely linked to the underpinning theory in learning outcomes 2 and 3.

In outcome 2 learners will gain an understanding of the working principles, construction and function of differing steering systems. Delivery should include why different types of steering are used for different purposes, and which machines use what type. Learners will also gain an understanding of the principles of GPS steering both for guidance of machinery and for steering of machinery. The different options should be explained along with relative accuracy and costs, along with where the use of certain accuracy is acceptable. Delivery is likely to include a range of classroom based activities, but it would be helpful if these are supported by workshop and practical demonstrations to help learners to put their knowledge into context.

For outcome 3 delivery needs to be planned to enable learners to identify the symptoms, characteristics and causes of common steering faults. Delivery is likely to include classroom based activities supported by practical demonstrations, and closely linked to the practical activities for outcome 1.

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Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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Unit 215

Service and Repair Tyres and Tracks on Land-based Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repair operations on tyres, wheel assemblies and tracks 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.

The aim of this unit is to provide the learner with the knowledge and skills required to perform service and repair operations on tyres, wheel assemblies and/or track and their components on land based equipment

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on tyres, wheel assemblies or tracks and their components
2. Know the types, construction and operating principles of tyres, wheel assemblies and tracks and their components
3. Know how to carry out service and maintenance operations on tyres and tracks

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO16.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 215 Service and Repair Tyres and Tracks on Land-based Equipment

Outcome 1 Be able to perform service and repair operations on tyres, wheel assemblies or tracks and their components

Assessment Criteria

The learner can:

1. **Remove dismantle, repair and reinstate** tyres and wheel assemblies or tracks, their running gear and components to manufacturer's specifications
2. Attach, adjust and remove **stability and tractive aids**
3. **Identify and rectify faults** relating to tyres, wheel assemblies or tracks and their components

Range

Wheels and track running gear

Wheel rim types, tyre securing aids, capabilities, track types, track tensioners types, running gear,

Tyre construction and data

Pneumatic and solid tyre types, size, ply rating, load index, speed rating, orientation, ground pressure, tractive capability, inflation pressures, tension, ballasting

Tractive aids

Floatation aids, weights and liquid ballast, dual wheels, cage wheels and wheel strakes, 4 wheel drive (equal and unequal sized wheels), PTO driven axles, differential locks

Weight distribution and transfer

Wheel slip, slip control, ground pressure, balance, tyre pressures, dual/cage wheels, liquid ballast and weights, decreasing and variable loads, extending arms and loaders, counter balances

Track widths

Axle loadings, tyre loadings, gross weight, max width on highways, police notification, escort vehicles, road and bridge restrictions, stability and traction

Unit content

Remove, dismantle, repair and reinstate (Choice of either tyres or tracks)

Can safely remove, dismantle, repair and reinstate wheel and tyre assemblies, set adjustable wheel rim assemblies, align wheel dishes to rims, repair a puncture, seat a tyre bead

Can safely remove, dismantle, repair and reinstate track assemblies and their associated running gear, adjust track tension and alignment to manufacturer's specifications

Stability and tractive aids

Can select, attach and remove appropriate stability and traction aids as listed in the range notes above observing safe working practices, legislative requirements and manufacturer's specifications

Identify and rectify faults

Can recognise and rectify faults in wheel and tyre assemblies' e.g. abnormal wear, wheel rim concentricity and run out, vibration, tyre creep, air pressure loss / puncture, wheel rim creaks, attachment failures

Can recognise and rectify faults in tracks and their running gear e.g. abnormal wear, track alignment, track jump off, vibration, incorrect tension, track roller and drive gear failure

Unit 215 Service and Repair Tyres and Tracks on Land-based Equipment

Outcome 2 Know the types, construction and operating principles of tyres, wheel assemblies and tracks and their components and how to carry out service and maintenance operations

Assessment Criteria

The learner can:

1. Outline the types, **construction and operating principles** of tyres, and wheel assemblies and tracks, their running gear and components
2. Describe the types, construction and **applications** of wheels, tyres tracks and tractive aids
3. Outline the implications of **weight distribution and transfer** on tractive performance and stability
4. Outline the implications of **track widths, weight distribution and transfer**, ballast and tractive aids on legislative and legal responsibilities

Range

Wheels and track running gear

Wheel rim types, tyre securing aids, capabilities, track types, track tensioners types, running gear

Tyre construction and data

Pneumatic and solid tyre types, size, ply rating, load index, speed rating, orientation, ground pressure, tractive capability, inflation pressures, tension, ballasting

Tractive aids

Floatation aids, weights and liquid ballast, dual wheels, cage wheels and wheel strakes, 4 wheel drive (equal and unequal sized wheels), PTO driven axles, differential locks

Weight distribution and transfer

Wheel slip, slip control, ground pressure, balance, tyre pressures, dual / cage wheels, liquid ballast and weights, decreasing and variable loads, extending arms and loaders, counter balances

Track widths

Axle loadings, tyre loadings, gross weight, max width on highways, police notification, escort vehicles, road and bridge restrictions, stability and traction

Unit content

Construction and operating principles

Knows the types, operating principles and construction of wheel and tyre assemblies, tractive aids and tracks and their associated running gear components

Applications

Understands the types, construction, function and application of wheels, tyres, tracks and tractive aids

Weight, distribution and transfer

Knows and understands the implications of weight transfer and distribution as listed in the range notes, on performance and stability, and the actions to take to improve performance

Track widths, weight distribution and transfer

Knows the safety, legislative and legal implications regarding track widths, weight distribution and transfer, ballast and tractive aids

Unit 215 Service and Repair Tyres and Tracks on Land-based Equipment

Outcome 3 Know how to carry out service and maintenance operations on tyres and tracks

Assessment Criteria

The learner can:

1. Describe the **methods of removing dismantling, repairing and reinstatement** of tyres and wheel assemblies and tracks, their running gear and components
2. Describe how to carry out land-based equipment **tests and checks**
3. Describe how to identify and **rectify faults relating to tyres, wheel assemblies and tracks** and their components

Range

Wheels and track running gear

Wheel rim types, tyre securing aids, capabilities, track types, track tensioners types, running gear

Tyre construction and data

Pneumatic and solid tyre types, size, ply rating, load index, speed rating, orientation, ground pressure, tractive capability, inflation pressures, tension, ballasting

Tractive aids

Floatation aids, weights and liquid ballast, dual wheels, cage wheels and wheel strakes, 4 wheel drive (equal and unequal sized wheels), PTO driven axles, differential locks

Weight distribution and transfer

Wheel slip, slip control, ground pressure, balance, tyre pressures, dual/cage wheels, liquid ballast and weights, decreasing and variable loads, extending arms and loaders, counter balances

Track widths

Axle loadings, tyre loadings, gross weight, max width on highways, police notification, escort vehicles, road and bridge restrictions, stability and traction

Unit content

Methods of removing, dismantling, repairing and reinstating

Methods and techniques of removing, dismantling, repairing and reinstating wheel and tyre assemblies and tracks and their running gear to manufacturer's specifications

Tests and checks

Methods and techniques used to carry out tests and checks, the appropriate equipment and calculations to apply and how to source the technical data required

Tests and checks to include: confirmation of 4 wheel drive inter axle ratio using calculation and mechanical tests

Suitability of tyre combinations, wheel rim conformity, tyre creep/slip, wheel alignment, tyre conformity/serviceability alignment and tension of tracks

Rectify faults relating to tyres, wheels and tracks

Methods and techniques used to identify faults and the procedures and practices required to rectify them to include: torque wind up, vibration and bouncing, non conformity, cracking/creaking, misalignment, uneven wear/rapid wear, deflation, de-lamination and track jump off

Unit 215 Service and Repair Tyres and Tracks on Land-based Equipment

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to service and repair tyres or tracks on land-based equipment, At all times when practical tasks are carried out or assessed an emphasis must be placed on safe working practices and current legislation. All maintenance must follow manufacturers' guidelines, found in service and operator manuals.

The repair of damaged tyres which require specialist repairs are not covered by this unit but the diagnosis of whether a tyre is serviceable is included.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment is involved. This unit requires the learner to undertake equipment maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

During practical assessment learners must be assessed on safe working practices particularly when inflating tyres that have been newly fitted and also when removing/refitting large wheel assemblies. In all operations where learners handle liquid ballast observation of safe environment working practices are to be observed.

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in servicing, dismantling, repairing, reinstating and adjusting tyres, wheel assemblies and tracks, making sure to comply with manufacturers' specifications and current legislation. Delivery also needs to include practice of the correct procedures for identifying and rectifying faults relating to tyres and tracks. Delivery should include as broad a range of equipment as possible to enable learners to gain a broad experience.

In outcome 2 learners need to experience the types, construction and operating principles of tyres, wheel assemblies and tracks and their components and how to service them. This should ideally be through visits to see as wide a range of equipment as possible, supplemented where necessary by audio visual material. Learners need to gain an understanding of the correct procedures for servicing and maintenance operations, together with the applications of wheels, tyres and tractive aids. Delivery also needs to include the implications of weight, distribution and transfer on tractive performance and stability.

In outcome 3 learners need to experience the methods on removing, dismantling, repairing and reinstatement of tyres, wheel assemblies and tracks and their running gear and components. This

should ideally be through visits to see as wide a range of equipment as possible, supplemented where necessary by audio visual material. Learners need to gain an understanding of the test and checks made to land-based equipment, together with the legislative and legal responsibilities.

Delivery of outcomes 1, 2 and 3 is likely to be closely linked; with practical activity in outcome 1 supported by the underpinning knowledge from outcome 2 and 3.

References

Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X
- Hillier V and Coombes P — *Hillier's Fundamentals of Motor Vehicle Technology, 5th Edition* (Nelson Thornes, 2004) ISBN 0748780823
- Whipp J and Brooks R — *Transmission, Chassis and Related Systems (Vehicle Maintenance & Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
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Websites

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www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 216

Service and Repair Land-based Cutting and Mowing Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of the construction, function and operation of cutting and mowing equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required for servicing land based cutting and mowing equipment

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. Be able to service cutting and mowing equipment
2. Know the construction, function and operation of cutting and mowing equipment
3. Know how the performance of cutting and mowing equipment is affected by conditions

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO17.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 216 Service and Repair Land-based Cutting and Mowing Equipment

Outcome 1 Be able to service cutting and mowing equipment

Assessment Criteria

The learner can:

1. **Identify cutting and mowing equipment** used in the land-based sector
2. **Dismantle, repair and reinstate cutting or mowing machinery and tools** to manufacturers' specifications
3. **Sharpen and adjust cutting mechanisms** to conform with manufacturers' specification
4. Identify **faults affecting cutting performance** and rectify to perform within the manufacturers' specification

Range

Powered equipment and hand tools

Used for cutting operations in ground care, agriculture forestry and arboriculture applications employing reciprocal, rotary, centrifugal, moving and stationary knives

Cutting actions

Rotary flail, cylinder and shear bar/shear blade, stationary knife, rotating knife, reciprocating knife, rotary blade, centrifugal chains and cords, saw blades and chains. Hand tools, shears and axes

Unit content

Identify cutting and mowing equipment

Types of cutting mechanisms, tools and equipment used in land-based engineering, their components, function and application

Dismantle, repair and reinstate cutting or mowing machinery and tools

Safe handling of sharp components, checking balance and alignment of rotary cutting components, adjusting the relationship of cutting components to one another using manufacturer's specifications and standards

Establishing that clearances and wear limits of cutting components are within manufacturer's specifications

Testing, cutting and mowing equipment performance

Sharpen and adjust cutting mechanisms

Saw blades and chains, rotary blades, stationary and moving / rotating knives/ reciprocating cutting mechanisms, flails and hand tools, cylinder, shear bar and shear blade

Routine and periodic maintenance of cutting mechanism, manual and mechanical sharpening methods, sharpening angles of cutting components

Setting cutting mechanisms to produce different crop lengths and to conform to manufacturer's specifications and standards

Faults affecting cutting performance

Excessive forward speed, excessive clearance between cutting elements, blunt cutting components, crop or material conditions, climate conditions, incorrect presentation of crop or material to cutting elements, damaged or broken cutting elements, incorrect sharpening

Unit 216 Service and Repair Land-based Cutting and Mowing Equipment

Outcome 2 Know the construction, function and operation of cutting and mowing equipment

Assessment Criteria

The learner can:

1. Describe the working **principles of cutting and mowing equipment and their components**
2. Describe how to **dismantle, repair and reinstate cutting and mowing equipment**
3. Describe the methods of **sharpening and setting cutting mechanisms** and components

Range

Powered equipment and hand tools

Used for cutting operations in ground care, agriculture forestry and arboriculture applications employing reciprocal, rotary, centrifugal, moving and stationary knives

Cutting actions

Rotary flail, cylinder and shear bar / shear blade, stationary knife, rotating knife, reciprocating knife, rotary blade, centrifugal chains and cords, saw blades and chains. Hand tools, shears and axes

Unit content

Principles of cutting and mowing equipment

Covering lawn and professional mowers, hedge trimmers, green crop mowers and toppers, harvester cutting mechanisms, saws, chippers and hand tools

Dismantle, repair and reinstate cutting and mowing equipment

Safe handling of cutting components and mechanisms, methods of adjustment and setting of cutting components, principle causes of poor cutting performance, measuring wear limits of cutting components, techniques used to balance and align cutting components

Sharpening and setting cutting mechanisms

The equipment and methods used to sharpen/set cutting mechanisms and the techniques used to test cutting performance to conform to manufacturer's specifications and standards. The sharpening angles of cutting components, Personal Protective Equipment (PPE) equipment required during sharpening operations, precautions to be exercised during sharpening operations e.g. fire hazards, cuts, burns, airborne particles and the maintenance of sharpening equipment

Unit 216 Service and Repair Land-based Cutting and Mowing Equipment

Outcome 3 Know how the performance of cutting and mowing equipment is affected by conditions

Assessment Criteria

The learner can:

1. Describe the **effect of crop/product type and conditions** on the cutting and mowing process
2. State **how adjustments and settings effect the performance** of cutting and mowing equipment

Range

Powered equipment and hand tools

Used for cutting operations in ground care, agriculture forestry and arboriculture applications employing reciprocal, rotary, centrifugal, moving and stationary knives

Cutting actions

Rotary flail, cylinder and shear bar/shear blade, stationary knife, rotating knife, reciprocating knife, rotary blade, centrifugal chains and cords, saw blades and chains. Hand tools, shears and axes

Unit content

Effect of crop/product type and conditions

The effect of climatic and crop conditions on cutting performance e.g. tough, damp, green/over ripe crops, laid crops, light/heavy crops, excessive or low feed rates and cutting speeds, uneven crop presentation to cutting mechanisms, abrasive materials and foreign objects contained within the crop

How adjustments and settings affect performance

The effect of blunt cutting mechanisms and excessive blade clearances, excessive/low feed rates and forward speeds, low rotational speed of cutting mechanisms, misaligned cutting components, unbalanced cutting components, miss-timed cutting components, incorrect height adjustment of cutting equipment, insufficient blades fitted to cylinders. The consumption of power and fuel caused by poor cutting performance

Unit 216 Service and Repair Land-based Cutting and Mowing Equipment

Notes for guidance

This unit is designed to provide the learner with a sound knowledge and understanding of the service, setting and repair of cutting and mowing equipment. The unit covers a range of cutting and mowing equipment appropriate to cover the areas of land based engineering appropriate to the area of study. It is expected that throughout the unit the learner should be able to demonstrate safe working practices and demonstrate the use of the appropriate PPE equipment

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery maintenance under close supervision. At all times practical maintenance tasks should be carried out to manufacturers' specifications. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

Delivery of outcome 1 is likely to be largely practically based. The learner will learn how to identify a wide range of cutting and mowing equipment and their components. Learners will need supervised practical opportunities to dismantle, repair and reinstate cutting and mowing equipment. They will also gain the skills to sharpen and set two cutting mechanisms to manufacturer's specification. Learners will be required to identify faults affecting cutting performance and rectify them to perform within manufacturer's specification.

In Outcome 2 the learner will gain an understanding of the principles of cutting and mowing equipment and their components, how to dismantle repair and reinstate, sharpen and set. It is anticipated that the delivery of this unit will require some formal delivery but it should also be delivered in conjunction with outcome 1.

In Outcome 3 the learner will investigate how crop conditions, incorrect settings and operation of the machine will affect its performance. Delivery may include classroom based activities but it will be particularly useful for learners to see different types of crop and conditions in a practical setting.

References

Books

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www.iagre.org	Institution of Agricultural Engineers

Unit 217

Service and Repair Land-based Harvesting and Processing Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing harvesting and processing equipment 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required service and repair harvesting and processing equipment.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on harvesting and processing equipment
2. Know how to service and repair harvesting and processing equipment

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO18.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 217 Service and Repair Land-based Harvesting and Processing Equipment

Outcome 1 Be able to perform service and repair operations on harvesting and processing equipment

Assessment Criteria

The learner can:

1. Dismantle, repair and reinstate **harvesting** and **processing** equipment to the manufacturer's specifications and standards
2. Identify and rectify **performance faults** in equipment to achieve optimal performance
3. Identify and rectify faults in equipment which cause crop or product loss
4. Prepare equipment for periods of storage or lay up when not in use

Range

Harvesting and processing equipment

Green crop harvesters, combine harvesters, root crop harvesters, balers and presses, grain driers, timber processors, wrappers, chippers, choppers, grinders, mowers, conditioners, pasteurisation, grading equipment

Unit content

Performance faults

Failure to meet required standards and performance as specified by equipment manufacturers, legislation, customer or storage requirements, crop loss, crop damage, chop length, bale shape and density, pasteurisation

Unit 217 Service and Repair Land-based Harvesting and Processing Equipment

Outcome 2 Know how to service and repair harvesting and processing equipment

Assessment Criteria

The learner can:

1. Describe the construction, types and function of harvesting and processing equipment
2. Describe how to remove, dismantle, repair, reinstate and setup harvesting and processing equipment to **manufacturer's specifications**
3. Describe the **processes** used in harvesting and processing equipment
4. Describe the methods of **material handling** within the harvesting process
5. Describe the appropriate **methods of clearing blockages** from harvesting and processing equipment
6. Identify the **causes of crop or product loss and poor sample quality** contamination, damage, wastage and non compliance

Range

Green crop harvesters, combine harvesters, root crop harvesters, balers and presses, grain driers, timber processors, wrappers, chippers, choppers, grinders, mowers, conditioners, pasteurisation, grading equipment

Unit content

Manufacturer's specification

Operators manual, service manual, workshop manuals

Methods of clearing blockages

Feed mechanisms (manual and powered), manual unloading/emptying of equipment, pressurised air/water, tightening of torque limiting devices and belt drives

Processes

Separation, drying, pasteurisation, compressions, tying, wrapping, grinding, chipping, chopping, cleaning grading, disposal/ dispersal of waste products, threshing, metering

Material handling

Elevating, lifting, conveying, transfer, presentation, orientation, packing, blowing, gathering

Causes of crop or product loss and poor sample quality

Cleanliness, hygiene, bacterial count, sizing, bale/ timber sizes, chop length, bruising, cracking, density, leakage

Unit 217 Service and Repair Land-based Harvesting and Processing Equipment

Notes for guidance

This unit aims to give learners an understanding of the construction and function of harvesting and processing equipment, and to develop skills in carrying out basic servicing and repairs.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of machinery is involved. This unit requires the learner to undertake machinery maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

The learner will be expected to work within recognised industry standards and legislation and be familiar with the requirements of risk assessments required for the tasks undertaken. All maintenance must follow manufacturers' guidelines, found in service and operator manuals.

In outcome 1, the learner will learn how to carry out basic repairs and adjustments to harvesting and processing equipment. Learners will also gain the skills to identify and rectify basic faults and be able to prepare the equipment for either long or short term storage. Delivery is likely to be practically based, including demonstrations and supervised practical experience. It will be helpful if delivery is closely linked to the underpinning knowledge and understanding of outcome 2.

In outcome 2 delivery needs to include the construction and function of harvesting and processing equipment, and the procedures for dismantling, repairing reinstatement and setting up of the equipment after repair to manufacturers specification. Learners will gain an understanding of the process used in the harvesting and processing equipment, including the methods of handling the harvested material within the harvesting process. The methods of dealing with blockages safely using recognised systems of work as described by the manufacturer or as required by any risk assessment will also be covered, along with the causes of loss and product damage, for example poor sample damage contamination and deviation from either manufacturers or quality specification. Delivery is likely to include classroom based sessions supported by workshop and practical activities. It would be beneficial for learners to tour a workshop and watch the safe demonstration of various pieces of specialist machinery.

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www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 218

Service and Repair Land-based Soil Preparation and Plant Establishment Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of the construction, function and operation of soil preparation, cultivation and plant establishment equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required to service and repair soil preparation and plant establishment equipment

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. Be able to service and set-up soil preparation equipment
2. Know the construction, function and operation of soil preparation, cultivation and plant establishment equipment
3. Know the factors which effect equipment and performance

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards This unit is linked to the 029NLEO19

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 218 **Service and Repair Land-based Soil Preparation and Plant Establishment Equipment**

Outcome 1 Be able to service and set-up soil preparation equipment

Assessment Criteria

The learner can:

1. Remove, dismantle, **repair and reinstate** soil preparation and plant establishment machinery to manufacturers' specification
2. **Set up** trailed and mounted **machines** to work effectively with the prime mover

Range

Soil preparation and plant establishment equipment

Soil inversion equipment, rigid, sprung and powered cultivators, seed placement equipment, granulated and liquid fertiliser applicators, sprayers and irrigation equipment

Unit content

Repair and reinstate

Methods used to service and maintain, dismantle, repair and reinstate soil preparation and establishment equipment: assessment of wear, refurbishment of soil engaging parts, alignment, outputs, for chemical applicators fit for purpose, set equipment to operation settings

Set up machines

The relationship and geometry of trailed and mounted soil preparation and plant establishment equipment to the prime mover check and adjust weight transfer, stability and ballasting, track width and tyre pressures to suit the application

Unit 218 Service and Repair Land-based Soil Preparation and Plant Establishment Equipment

Outcome 2 Know the construction, function and operation of soil preparation, cultivation and plant establishment equipment

Assessment Criteria

The learner can:

1. Describe the **types, construction and function** of soil engaging, preparation and cultivation machinery and plant establishment equipment
2. Describe how to **remove, dismantle, repair and reinstate** soil preparation, cultivation and plant establishment machinery and equipment
3. Describe how to set up and **verify the performance** of soil preparation, cultivation and plant establishment equipment
4. Describe the **methods and mechanisms** used to meter and calibrate application rates

Range

Soil preparation and plant establishment equipment

Soil inversion equipment, rigid, sprung and powered cultivators, seed placement equipment, granulated and liquid fertiliser applicators, sprayers and irrigation equipment

Unit content

Types, construction and function

Soil engaging equipment to move, lift, invert, drain, separate, profile and prepare the land, plant establishment equipment to sow, irrigate, fertilise, apply protection products and spread

Remove, dismantle, repair and reinstate

Soil preparation, cultivation, plant establishment machinery and equipment to manufacturer's specification, methods of identification of the causes of excessive component and equipment wear

Verify the performance

The methods and procedures for setting up soil preparation and plant establishment equipment to enable work within manufacturer's specifications, and the checks necessary to ensure accuracy and quality of work

Methods and mechanisms

The working principles and functions of mechanisms used to meter and calibrate application rates, for example planters, seeders, liquid, solids and granular fertiliser and crop protection applicators, spreaders

Unit 218 Service and Repair Land-based Soil Preparation and Plant Establishment Equipment

Outcome 3 Know the factors which effect equipment and performance

Assessment Criteria

The learner can:

1. Outline the **impact of soil, seed, fertiliser types, crops, weather conditions on equipment performance** settings

Range

Soil preparation and plant establishment equipment

Soil inversion equipment, rigid, sprung and powered cultivators, seed placement equipment, granulated and liquid fertiliser applicators, sprayers and irrigation equipment

Unit content

Impact of soil, see, fertiliser types, crops, weather conditions

Soil: sand, clay, silt, peat, chalk, loam

Fertiliser Types: Organic (manure – animal and plant bi products, potash, bomeal) Chemical (sodium nitrates, ammonium sulphate and ammonium salts, chemical compounds containing nitrogen) liquid, granule

Crops: cereals, grains, roots, legumes, maize, brassicas

Weather conditions: temperature, humidity, rainfall, sunlight, wind, ice, frost

Equipment performance

The adjustments and settings required to compensate for equipment performance affected by soil condition, fertiliser types, crop, climate, environment and weather conditions, equipment tolerance limits

Unit 218

Service and Repair Land-based Soil Preparation and Plant Establishment Equipment

Notes for guidance

This unit is designed to provide the learner with the knowledge and understanding of how to service, maintain and repair soil preparation and plant establishment equipment, together with the opportunity to develop their practical skills in setting up and servicing the equipment. An emphasis must be put on safe working practices, the personal risks, current legislation and dangers of handling machinery and equipment, chemicals, treated seeds and fertilisers.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in removing, dismantling, repairing and reinstating a range of equipment. Learners also need to gain experience in setting up machines, and in checking and adjusting settings according to the application and conditions. It would be beneficial if delivery of this outcome is preceded by or linked closely to the underpinning knowledge and understanding delivered through outcomes 2 and 3.

In outcome 2, delivery is likely to include a range of classroom based activities supplemented by practical demonstrations. It is important that delivery includes all the types of equipment and machinery included in the range. Learners also need to gain knowledge of how to set up and verify the performance of a range of soil preparation, cultivation and plant establishment equipment, and how to meter and calibrate application rates.

In outcome 3, delivery is likely to be closely linked to the practical activities in outcome 1. Learners need to gain an overview of how soil, seed crop and fertiliser types, and weather conditions affect equipment performance, and how to make the necessary adjustments. Learners also need to gain an appreciation of situations outside the tolerance limits of the equipment, i.e. when equipment use may be unsafe or unsuitable.

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www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 219

Service and Repair Land-based Transport, Handling and Storage Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of construction, function and operation of transport, handling and storage equipment 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.

The aim of this unit is to provide the learner with the knowledge and skills required when working with transport, handling and storage equipment within land based operations

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to service and repair transport, handling and storage equipment
2. Know the construction, function and operation of transport, handling and storage equipment

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO20.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SCC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 219

Service and Repair Land-based Transport, Handling and Storage Equipment

Outcome 1

Be able to service and repair transport, handling and storage equipment

Assessment Criteria

The learner can:

1. **Clean and prepare** transport, handling and storage equipment for service and maintenance
2. **Remove, dismantle, repair and reinstate** transport, handling and storage equipment to manufacturers specifications
3. Safely **clear blockages** from equipment

Range

Transport, handling and storage equipment

Lifting equipment (cranes, forklifts, handlers loaders, and elevated platforms) winches, skylines and cable systems, latching and hitching systems, trailers, tankers forage and feed wagons, timber forwarders, conveyors, elevators, augers, suction blowers, fixed and mobile tanks and silos, slurry storage equipment, crop storage equipment, temperature humidity control equipment, injectors, bale collectors and grass collection systems

Unit content

Clean and prepare

Methods of cleaning and preparing transport, handling and storage equipment, for example removal of crop residue, vermin infestation, hazardous substances, the personal and environmental precautions to be taken whilst carrying out cleaning and preparation works

Remove, dismantle, repair and reinstate

Methods of assessing the necessary repairs, the removal and dismantling procedures, repair and reinstatement procedure, safe working practices of working within confined spaces and this type of equipment, safe working practices and procedures to ensure isolation of oil, water, gas, electricity and fuel supplies

Clear Blockages

Methods and precautions to be employed when clearing obstructions and blockages by means of manual and powered methods from transport handling and storage equipment

Unit 219 **Service and Repair Land-based Transport, Handling and Storage Equipment**

Outcome 2 Know the construction, function and operation of transport, handling and storage equipment

Assessment Criteria

The learner can:

1. **Identify** transport, handling and storage **equipment** and their components
2. Explain how to **remove, dismantle, repair and reinstate** transport, handling and storage equipment and their components
3. Describe how to **identify and isolate services** from handling and storage equipment
4. Describe the layout and **characteristics** of transport, handling and storage equipment
5. Describe how to **clean and prepare** transport, handling and storage equipment for service and repair operations
6. Describe the methods of **shortening, lengthening and joining** belts, elevators and conveyors
7. Define the appropriate methods of **clearing blockages** from transport, handling and storage equipment

Range

Transport, handling and storage equipment

Lifting equipment (cranes, forklifts, handlers loaders, and elevated platforms) winches, skylines and cable systems, latching and hitching systems, trailers, tankers forage and feed wagons, timber forwarders, conveyors, elevators, augers, suction blowers, fixed and mobile tanks and silos, slurry storage equipment, crop storage equipment, temperature humidity control equipment, injectors, bale collectors and grass collection systems

Unit content

Identify equipment

Identify the construction, function and operation of transport, handling and storage equipment and their component parts

Remove, dismantle, repair and reinstate

The methods and procedures of removing, dismantling, repairing and reinstating equipment and components to manufacturers and legislative requirements for the purposes of service, maintenance and repair works

Identify and isolate service

Methods of identifying the type of and safe isolation methods of services e.g. oil, water, gas, electric and fuel

Characteristics

Identify the layout and characteristics of transport, handling and storage equipment

Clean and prepare

Procedures used when cleaning and preparing to carry out service and maintenance operations

Shortening, lengthening and joining

The methods and techniques used to shorten, lengthen and join belts and chains, conveyors and elevators

Clearing blockages

The appropriate procedures, techniques and methods of clearing obstructions and blockages

Unit 219

Service and Repair Land-based Transport, Handling and Storage Equipment

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to maintain and repair transport, handling and storage equipment. At all times when practical tasks are carried out or assessed an emphasis must be placed on safe working practices and current legislation. All maintenance must follow manufacturers' guidelines, found in service and operator manuals. In this unit particular attention should be placed on the safe practices to be employed when working with ladders at heights and confined spaces.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment is involved. This unit requires the learner to undertake equipment maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in servicing, cleaning and preparing equipment, making sure to comply with manufacturers' specifications and current legislation. Delivery also needs to include practice of the correct procedures for clearing blockages. Delivery should include as broad a range of equipment as possible to enable learners to gain a broad experience.

In outcome 2 learners need to experience a range of equipment and components so that they are able to identify and correctly name them. This should ideally be through visits to see as wide a range of equipment as possible, supplemented where necessary by audio visual material. Learners need to gain an understanding of the correct procedures for servicing and repair, cleaning and preparation and clearing blockages, together with the methods of shortening, lengthening and joining belts. Delivery also needs to include how to identify and isolate services, and why this is important. Delivery of the layout and characteristics of transport, handling and storage areas could be achieved through a series of farm visits.

Delivery of outcomes 1 and 2 is likely to be closely linked, with practical activity in outcome 1 supported by the underpinning knowledge from outcome 2.

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Unit 220

Service and Repair Electrical Systems on Land-based Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing electrical systems and their components used in land-based equipment 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to carry out service and repair on electrical systems within land-based equipment

The learner will need to ensure they comply with current legislation and guidelines to complete this unit.

*. Primary AC systems and components limited to the identification and verification of the type of power supply, the risks and hazards involved and the isolation of the electrical source. How to carry out fundamental operations / repairs e.g. check if circuit is live and has integrity, and check overload protection.

- (i) single
- (ii) 3 phase
- (iii) voltage and colour coding – 415, 240, 110

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on electrical systems and their components used in land-based equipment
2. Know the construction, function and operation of electrical systems and circuits and their components

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO22.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 220 Service and Repair Electrical Systems on Land-based Equipment

Outcome 1 Be able to perform service and repair operations on electrical systems and their components used in land-based equipment

Assessment Criteria

The learner can:

1. Identify **electrical circuits and components** and their functions from wiring diagrams and visual recognition
2. **Perform tests** using equipment and practices to measure and verify the correct operation of electrical systems and their components
3. **Identify and rectify faults** in electrical systems and components
4. Maintain the **integrity of electrical systems**
5. Remove dismantle, **rectify faults, repair and reinstate** electrical components and circuits to manufacturer's specifications and standards

Range

Electrical systems and their components

12 volt electrical circuits and components used within them, series and parallel connections, power supply and battery types, circuit protection devices, fixed and variable resistors, diodes, relays, switches, wire types and sizes, electrical consumers e.g. starter motors, alternators

Unit content

Electrical circuits and components

Recognition and identification of electrical components both visually and from wiring diagrams and symbols, as detailed in the range

Perform tests

Methods and equipment used to carry out electrical testing and verification of electrical component operation including, voltage, current, continuity, resistance, battery and condition

Identify and rectify faults

Methods used to identify and rectify faults as outlined in performance tests

Integrity of electrical systems

Methods used to maintain the integrity of wiring harnesses, connectors and connections, earthing, power supplies and batteries

Rectify faults, repair and reinstate

Methods of identifying and rectifying open circuit, short circuit, high resistance and poor connection faults

Unit 220 Service and Repair Electrical Systems on Land-based Equipment

Outcome 2 Know the construction, function and operation of electrical systems and circuits and their components

Assessment Criteria

The learner can:

1. Identify and **interpret** electrical **circuit diagrams**
2. Summarise **Ohm's law**, its application and principles
3. Compare the specification, safe maintenance and **charging of different types of battery**
4. Describe the **principles, construction and function of electrical circuits** and their components
5. Describe how to remove dismantle, test, verify, repair and **reinststate electrical circuits and their components**
6. Outline the **risks** posed **to electrical systems** and components by other activities or incidents

Range

Electrical systems and their components

12 volt electrical circuits and components used within them, series and parallel connections, power supply and battery types, circuit protection devices, fixed and variable resistors, diodes, relays, switches, wire types and sizes, electrical consumers e.g. starter motors, alternators

Unit content

Interpret circuit diagrams

Identification and interpretation of electrical circuit and wiring diagrams, component symbols, colour coding, wire identification and sizing, series and parallel connections, method of identifying alternating and direct current, common voltages used and their application

Ohms Law

Explain Ohms Law its applications and principles

Charging of different types of battery

Identification of lead acid, gel, maintenance free and dry cell their specifications, maintenance and safe working practices when handling, charging and connecting batteries

Principles, construction and function of electrical circuits

Starter circuits, inertia, pre engaged, heat start, safety start switching, charging circuits, alternators, rectifiers, lighting circuits, indicators, brake lights, side, head, marker and work lights, instrumentation, fuel, temperature, tachometer, hour meter, spark ignition, spark generation, ancillary circuits, wiper motors, stop circuits, ventilation, horn, switches, actuators, safety and circuit protection, battery isolation, safety isolation, fuses and fusible links, thermal switches, over / under voltage switching, relays, Residual Current Device (RCD), earth bonding and double insulation, printed circuits

Reinststate electrical circuits and their components

Methods of testing, removal, dismantling, repair, reinstatement and verification to manufacturer's specifications to include all the systems detailed above

Risks to electrical systems

The risks posed to electrical systems and components by other activities / incidents welding, short circuit, battery open circuit, over charging, reverse polarity. Risks posed when battery gasses are exposed to sparks and naked flames

Unit 220 Service and Repair Electrical Systems on Land-based Equipment

Notes for guidance

This unit forms the foundation that is essential to complete many workshop activities. This unit has been designed to provide learners with the knowledge and understanding of the service, maintenance and repair of electrical systems. At all times an emphasis must be put on safe working practices. Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units involving machinery and equipment. This unit requires the learner to undertake electrical component testing and repair under close supervision. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout

A full understanding of the many applications and use of a multi-meter are an essential part of this unit.

Delivery of outcome 1 is likely to be largely practical, including demonstrations and supervised practical activities. It might be helpful if this is preceded by delivery of the underpinning knowledge in outcome 2, or taught closely alongside. Learners will need to gain skills in testing electrical systems and components, in identifying faults and in providing the necessary repairs. It will be important to cover a wide range of systems and components as shown in the range.

Delivery of outcome 2 is likely to involve classroom and electrical workshop based sessions. Learners need to gain an understanding of Ohm's Law, and its application and relevance to land-based electrical systems and components. It will be helpful for learners to see a range of electrical circuits, and for them to create circuits from the relevant circuit diagrams to reinforce theoretical principles learned. It is important to ensure the practical application to land-based engineering is reinforced through examples where possible.

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www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 221

Service and Repair Hydraulic Systems and Components on Land-based Equipment

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and maintaining hydraulic systems and their components 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required to service and repair hydraulic systems and components in land based equipment

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and maintenance operations on hydraulic systems and their components
2. Know the construction, function and operation of hydraulic circuit systems and their components used in land based engineering applications

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO24

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 221 Service and Repair Hydraulic Systems and Components on Land-based Equipment

Outcome 1 Be able to perform service and maintenance operations on hydraulic systems and their components

Assessment Criteria

The learner can:

1. **Identify** and locate, **hydraulic systems** and their components
2. **Build and test** a basic hydraulic circuit
3. Prepare the hydraulic system to be tested and **carry out tests** using system diagnostic tools
4. **Remove dismantle, repair and reinstate** hydraulic systems and components to manufacturer's specifications and factory settings

Range

Open and closed centre circuits, single and double acting services, high and low pressure circuits and their components

Unit content

Identify hydraulic systems

Identification of hydraulic circuits, their components and the relationships of components to one another

Build and test

The information and methods required to construct and test a basic hydraulic circuit containing, pump, control valve, relief valve and consumer

Carry out tests

Procedures to be undertaken prior to a hydraulic test being carried out, selection and use of appropriate test equipment and diagnostic tools to measure hydraulic pressure, flow and oil temperature, procedures for carrying out diagnostic testing and adjustment of components and systems to manufacturer's specifications, diagnostic tests at correct operating temperature, to include system residual pressure and line tests, use of pressure differential gauges, diagnosis of position, draft and response controls

Remove, dismantle, repair and reinstate

Methods of removing, dismantling, repairing and reinstating systems and components to manufacturer's specifications and factory settings

Methods to safely release stored energy in systems and components, the adjustment procedures for pressure relief valve and maintaining valves

Unit 221 Service and Repair Hydraulic Systems and Components on Land-based Equipment

Outcome 2 Know the construction, function and operation of hydraulic circuit systems and their components used in land based engineering applications

Assessment Criteria

The learner can:

1. Describe how to read and **interpret hydraulic circuit diagrams** and symbols
2. Describe how to **remove, dismantle, repair and reinstate** hydraulic components and systems
3. Describe different **types of hydraulic circuits** and the construction and function of hydraulic system components
4. Describe primary **causes of hydraulic failure** and systems

Range

Open and closed centre circuits, single and double acting services, high and low pressure circuits and their components

Hydraulic components and systems

Pumps and motors (fixed and variable displacement), valves (pressure maintaining, relief , shock, control, directional flow, orbital and priority valves pressure differential and pilot operated valves), distributors, solenoid, Rams (single and double acting and cushioned), flow dividers, restrictors, reservoirs, accumulators, filters,(suction, high pressure and strainers)

Unit content

Interpret hydraulic circuit diagrams

How to recognise and interpret symbols (e.g. flow line, port, drain, pump/motor, measuring devices, rotary actuator, pressure control, directional control, spring, fluid conditioner, direction of fluid flow) and hydraulic circuit diagrams, circuit components

Remove, dismantle, repair and reinstate

Methods used to prepare hydraulic circuits for rectification work and reinstatement to manufacturer's specifications, procedures to be used for the safe removal of hydraulic components, identification of the types of hydraulic pipes, hoses and fittings and their applications

Procedures for carrying out diagnostic testing and adjustment of components and systems to manufacturer's specifications, diagnostic tests at correct operating temperature, to include system residual pressure and line tests, use of pressure differential gauges, diagnosis of position, draft and response controls, the adjustment procedures for pressure relief valve and maintaining valves

Types of hydraulic circuits

High and low pressure circuits including combined high / low pressure circuits, fixed and variable displacement circuits, open and closed centre circuits, load sensed circuits, auxiliary systems

Causes of hydraulic failure

Low oil levels, inappropriate oils, contamination, cavitation, overload

Unit 221 Service and Repair Hydraulic Systems and Components on Land-based Equipment

Notes for guidance

This unit is designed to provide learners with the knowledge, skills and understanding to service, maintain and repair standard hydraulic systems and components and carry out simple diagnostic tests. Learners will also gain an understanding of the use of hydraulic symbols, basic circuits and recording procedures.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of machinery is involved. This unit requires the learner to undertake machinery maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety and current legislation must be strictly enforced and repeated throughout

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in using test equipment, and removing, dismantling, repairing and reinstating systems and components, making sure to comply with manufacturers' specifications and current legislation. It would be helpful if delivery is preceded by the underpinning knowledge and understanding from outcome 2, or closely linked to it.

For outcome 2, delivery is likely to include a mixture of classroom based activities, together with practical sessions to reinforce the knowledge and understanding gained. Learners need to gain knowledge of how to interpret hydraulic circuit diagrams, including the use of symbols.

This outcome will also cover learning how to remove, dismantle, repair and reinstate hydraulic systems and components, Learners also need to gain an understanding of the primary causes of failure of hydraulic systems.

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Farmers Weekly

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www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 222

Service and Repair Pneumatic Systems and Components for Land-based Equipment

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of servicing and repairing systems and their components for pneumatic 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.

The aim of this unit is to provide the learner with the knowledge, understanding and skills required repair and service pneumatic systems and components for land based equipment.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to perform service and repair operations on pneumatic systems and their components
2. Know the construction, function and operation of pneumatic systems and components used in land-based engineering

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO26.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 222

Service and Repair Pneumatic Systems and Components for Land-based Equipment

Outcome 1

Be able to perform service and repair operations on pneumatic systems and their components

Assessment Criteria

The learner can:

1. Assemble or **repair pipes and hoses** used within pneumatic systems
2. **Build** and test a **basic** air pressure **circuit** (to include compressor, control valve, relief valve, pneumatic consumer)
3. **Remove, dismantle, repair and reinstate** pneumatic systems and components to manufacturers' specifications

Range

Pneumatic systems

Air braking, suspension and compressed systems

Unit content

Repair pipes and hoses

Detect air leaks, seal/repair pipes and hoses and construct a pneumatic pipe to manufacturer's standards and specifications

Build a basic circuit

Identify components required to construct a basic pneumatic circuit to include compressor, control valve, relief valve and a consumer, assemble basic circuit and carry out air pressure and leak tests

Remove, dismantle, repair and reinstate

Safely release pressure and condensation from pressure vessels and water traps, remove, dismantle, repair and reinstate system components to manufacturer's specifications

Unit 222

Service and Repair Pneumatic Systems and Components for Land-based Equipment

Outcome 2

Know the construction, function and operation of pneumatic systems and components used in land-based engineering

Assessment Criteria

The learner can:

1. **Identify pneumatic systems** and components
2. Describe the different **types of pneumatic circuit** including single line and twin line
3. Describe how to **remove, dismantle, repair and reinstate** pneumatic components and systems
4. Describe the construction, **types and function of pneumatic system components**
5. Describe the primary **causes of pneumatic failures** and their symptoms

Range

Pneumatic systems

Air braking, suspension and compressed systems

Unit content

Identify pneumatic systems

Recognise and identify different types of pneumatic systems and system components, compressors, pressure regulating valves, relief and dump valves, pressure control valves, handbrake and foot brake valves, diaphragm operated valves, air activated cylinders, air cushions, failsafe/emergency system components, receivers and driers

Types of pneumatic circuit

Identify the different types of air circuits using circuit diagrams and drawings for example, single and twin line, identify components and their symbols in circuit diagrams

Remove, dismantle repair and reinstate

Know the methods and techniques used to dismantle, remove, repair and reinstate air systems and their components to include the manufacture of pipes and hoses in line with manufacturers' specifications

Types and function of system components

Compressors, pressure regulating valves, relief valves, dump valves, air pressure control valves, handbrake valves, foot brake valves, diaphragm operated valves, air activated cylinder, air cushions, fail safe/emergency system components, air receivers and driers

Cause of pneumatic failure

Water, corrosion, fatigue, contamination and leaks, the associated symptoms and causes and the methods of testing systems and components

Unit 222 Service and Repair Pneumatic Systems and Components for Land-based Equipment

Notes for guidance

This unit has been designed to provide learners with the knowledge, skills and understanding to enable the learner to service and repair pneumatic systems and components related to land-based equipment.

At all times emphasis must be placed upon safe working practices and current legislation particularly those relating to pressure vessels. Emphasis also needs to be placed on the learner's ability to use circuit diagrams and the symbols used in pneumatic circuits.

Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the maintenance of equipment is involved.

This unit requires the learner to undertake equipment maintenance and repair under close supervision. There is significant emphasis on safe practices throughout the unit. Throughout delivery of the unit the emphasis should be on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In outcome 1 delivery is likely to be predominantly practically based, including demonstrations and supervised practical activities. Learners will need sufficient time to develop practical skills, particularly in assembling and repairing pipes and hoses, and removing, dismantling, repairing and reinstating pneumatic systems, making sure to comply with manufacturers' specifications and current legislation. Delivery also needs to include building and testing of basic air pressure circuits.

For outcome 2, delivery is likely to include a mixture of classroom based activities, together with practical sessions to reinforce the knowledge and understanding gained. Learners need to gain knowledge of the different types of pneumatic system and components, and their construction, type and function. Delivery also needs to cover how these should be dismantled, repaired and reinstated safely and in line with manufacturers' specifications. Learners will investigate types of pneumatic circuit, and the causes of pneumatic failure.

Delivery of outcomes 1 and 2 is likely to be closely linked, with practical activity in outcome 1 supported by the underpinning knowledge from outcome 2.

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www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
www.howstuffworks.com	How Stuff Works
www.iagre.org	Institution of Agricultural Engineers

Unit 223

Land-based Engineering Operations – Use Calculations

Level: 2

Credit value: 5

Unit aim

This unit aims to provide learners with an understanding of the principles of calculations that support engineering principles 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.

The aim of this unit is to provide the learner with the knowledge and skills required to use calculations to support land based engineering principles

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. Be able to use calculations to support engineering principles
2. Know how to use calculations to support engineering principles

Guided learning hours

It is recommended that **30** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

This unit is linked to the 029NLEO7.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 223

Land-based Engineering Operations – Use Calculations

Outcome 1

Be able to use calculations to support engineering principles

Assessment Criteria

The learner can:

1. Use ratios and **units of measurement** to express values
2. Use **conversion factors** to convert measurement values from one unit of measurement to another
3. **Calculate and measure**
 - Areas
 - Weights
 - Volumes
 - Angles
 - Flow rates and speeds
 - Scaling
4. Use physical and theoretical methods to establish measurements where relevant
5. Verify by calculation the **calibration** of machinery and equipment

Range

Area, weight, temperature, volumes, angles, flow rates, ratios, percentages, speeds, scaling, calibration, conversion factors, pressure and force, acceleration and de-acceleration

Unit content

Units of measurement

Units of measurement for machine performance (engine, transmission, hydraulic, pneumatic, and electrical) including power, energy, torque, force, specific gravity, temperature, pressure, velocity, acceleration, deceleration, reduction ratios, friction, density, flow, resistance, load, current, and noise

Conversion factors

Metric to imperial, imperial to metric

Calculate/measure

Weights, volumes, areas, angles, flow rates, speed, percentages and ratios, scaling of engineering drawings, methods of calculating fuel and oil consumption (expressed as a percentage, fuel consumption calculated in grams per kilowatt hour/ litres per hour/ fuel used per hectare/acre), torque reserve and lifting force

Calibration

Methods of calculating the calibration of machinery and equipment application, flow and speed rates, working widths, time elapsed, distances, areas, application rates, time periods to correspond with manufacturers specification units, areas and applications to confirm performance

Types of calibration: seeding rates, spray delivery, speeds, areas worked

Unit 223

Land-based Engineering Operations – Use Calculations

Outcome 2

Know how to use calculations to support engineering principles

Assessment Criteria

The learner can:

1. Identify **units of measurement** used to express values
2. State how to **use conversion tables**
3. Define the **mathematical formula** for
 - Area
 - Volume
 - Circumference
4. State the relationship between **speed and torque**
5. Describe how to **calculate power, torque, force, consumption and application rates**
6. Describe the methods and equipment required to **carry out a measuring task** and the factors that can distort measurements
7. Describe how to **measure**:
 - Speed
 - Velocity
 - Acceleration
 - Deceleration
 - Coefficient of friction

Range

Area, weight, temperature, volumes, angles, flow rates, ratios, percentages, speeds, scaling, calibration, conversion factors, pressure and force, acceleration and de-acceleration

Unit content

Units of measurement

Units of measurement for machine performance (engine, transmission, hydraulic, pneumatic, and electrical) including power (BHP, Kw, ECE, DIN and SAE), energy, torque, force, specific gravity, temperature., pressure, velocity, acceleration, deceleration, reduction ratios, friction, density, flow, resistance, load, current, and noise

Use conversion tables

Metric to imperial, imperial to metric

Mathematical formulas

Application of Ohms Law, Newton's Law of Motion, Boyles Law, Pascal's Law and the mathematical formulas for areas, volumes and circumferences

Calculate power, torque, force, consumption and application rates

Methods of calculating power, torque, force, consumption and application rates

Carry out a measuring task

Methods and equipment used to carry out a measuring task and the factors that can distort measurements e.g. temperatures, speeds, conditions, viscosities, obstructions, climate etc. Methods used to check calibration and application rates

Measure

Speed, velocity, acceleration, de-acceleration, and coefficient of friction, methods of calculating speed from ratios and ratios from input and output speeds

Unit 223 Land-based Engineering Operations – Use Calculations

Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to use calculations to support engineering principles. Emphasis should be made wherever possible to the application of these calculations in engineering operations.

Learners should have a sound knowledge of the use of measuring equipment of all types and a good working use of conversion tables and calculators.

Delivery of this unit is likely to be largely classroom based with learners given plenty of opportunity to practise carrying out conversions and calculations. Learners should also be encouraged to show their workings even where a calculator is used and to check their own work.

Practical sessions where learners are able to collect their own measurements and data sets may prove useful to motivate and engage the learners. This could be supplemented by case study material that requires calculations in a land-based engineering context. This unit could also be linked to other units in the qualification to add vocational relevance. This unit would particularly link with functional skills and aspects of delivery and assessment could be combined.

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www.howstuffworks.com

www.iagre.org

British Agricultural and Garden Machinery Association

Dept for Environment, Food and Rural Affairs

Welsh Assembly Government

Scottish Executive Environment and Rural Affairs Department

Department of Agriculture and Rural Affairs (Northern Ireland)

Health and Safety Executive

How Stuff Works

Institution of Agricultural Engineers

Unit 224

Undertake Work Related Experience in the Land-based Industries

Level: 2

Credit value: 10

Unit aim

The aim of this unit is to give learners the skills needed to identify, participate in and review work experience in a land-based environment. The unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

There are **four** learning outcomes to this unit. The learner will:

1. Know the range and scope of job roles within an environmental and land-based industry
2. Be able to use relevant documents and skills relating to work experience
3. Be able to plan and review self development during work experience
4. Be able to report on the work experience

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

n/a

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge

Unit 224 Undertake Work Related Experience in the Land-based Industries

Outcome 1 Know the range and scope of job roles within an environmental and land-based industry

Assessment Criteria

The learner can:

1. Describe different **types of jobs** within an environmental and land-based industry
2. Describe the **skills and qualifications** required for different types of jobs within an environmental and land-based industry

Unit content

Types of jobs

Types of jobs relevant to the industry: managerial, supervisory, team worker, trainee, volunteer, common job titles within the relevant industry, main duties and responsibilities

Skills needed to fulfil duties and responsibilities of appropriate jobs: job specific, vocational and personal

Skills and qualifications

Types of qualifications available to the industry, e.g. GCSE and A level, the Diploma (including Functional Skills), Apprenticeships (including Work-based Learning qualifications), Foundation Learning (Entry Level and Level 1), standalone/industry specific vocational, e.g. Centre-based (City & Guilds, Edexcel and others), practical competence based e.g. Certificates of Competence, other

Progression pathways from trainee or team worker positions to supervisory and management posts. Skills, qualifications and experience required to achieve career progression

Evaluate career and progression opportunities: advantages and disadvantages of identified pathways, suitability to personal interests, skills and qualifications, role of work experience in preparing for a selected career

Skills valued by employers: commitment and reliability, time management, people skills, confidentiality and discretion

Unit 224 Undertake Work Related Experience in the Land-based Industries

Outcome 2 Be able to use relevant documents and skills relating to work experience

Assessment Criteria

The learner can:

1. Locate three advertisements for jobs from **different sources** available within the environmental and land-based industry
2. Produce an **application** for work experience in the environmental and land-based sector
3. **Prepare for an interview** for work experience
4. **Undertake an interview** for work experience

Unit content

Different sources

Locate three advertisements from for example trade magazines, websites, employer approaches to the centre, local paper, Countryside Jobs Service

Application

Suitable work experience position based on existing skills, experience, qualifications, development of skills and experience to achieve future employment goals

Personal details, education and training, professional membership, training, employment history, qualifications held, skills and general information, declarations

Prepare for an interview

Interview preparation: research the business and job role, suitable dress and personal presentation, information to find out and suitable questions to ask

Undertake an interview

Interview performance: attend punctually and dressed appropriately, answering questions, completion of other tests (e.g. practical, aptitude), and reflection on interview performance

Unit 224

Undertake Work Related Experience in the Land-based Industries

Outcome 3

Be able to plan and review self development during work experience

Assessment Criteria

The learner can:

1. **Review own skills and experience** against the requirements for a specific industry
2. Prepare a **self development plan** for work experience
3. **Review** self development plan during and after work experience

Unit content

Review own skills and experience

Current skills and experience compared with those required for the job, identify training and development needs

Self development plan

New skills, knowledge, understanding, experience, development of existing knowledge and skills, training needed

Review

Skills, knowledge, understanding and experience that have been developed during work experience, impact on technical ability to perform the job role, work as a member of a team, future employability, future employment ambitions, further training and development

Unit 224 Undertake Work Related Experience in the Land-based Industries

Outcome 4 Be able to report on the work experience

Assessment Criteria

The learner can:

1. **Gather and prepare evidence** during the work experience
2. **Present information** to others on work experience

Unit content

Gather and prepare evidence

Position within the organisation structure, job description of work role, working practices, health and safety, daily work routine, diary of work activities, report from work experience provider

Present information

Written or oral report on the work experience, name of work experience provider, nature of the organisation (type of business, products or services), job role, health and safety, skills and knowledge developed

Unit 224

Undertake Work Related Experience in the Land-based Industries

Notes for guidance

Learners on centre-based courses should have experience of the type of work that they hope to do and of the expectations of potential future employers. Some level 2 learners are likely to already have experience of working in the land-based and environmental industries, so this unit seeks to provide new experience opportunities for these learners.

This unit should be undertaken in a real business environment relevant to the subject interest of the learner but work experience may be gained by a number of routes, e.g. as part of an industrial placement whilst within the programme, whilst working on a planned daily or weekly basis on the centre's commercial and/or educational facilities, whilst undertaking voluntary work within the industry, or as a member of a group of learners invited to carry out practical work on a suitable business.

Any Act or legislation that is sector specific should be adhered to. This includes duty of care if working with animals.

Learners should complete the equivalent of 4 weeks (or 150 hours) work experience to achieve this unit. Centres should be mindful of their responsibilities for ensuring that work placements have appropriate supervision, insurance and health and safety policies in place and that learners have access to appropriate support whilst on placement.

In Outcome 1, learners will explore the different job roles, responsibilities and job titles commonly associated with them in their specialist sector. This background understanding is likely to require some classroom teaching but learners should be encouraged to explore the range of employment opportunities within their specialist sector. It would be appropriate for employers to be invited to outline to learners their expectations in the workplace. Learners will be required to consider the skills and qualifications that are required for appropriate jobs, and should be encouraged to think about the skills and qualifications that they may need to acquire to achieve their employment ambitions. This should also help them to identify a suitable work experience placement.

Outcome 2 involves learners undertaking the process of applying for work experience. They will need to locate suitable job adverts but can be supported by centres suggesting suitable placements. When applying for work experience learners should produce, as a minimum, a detailed curriculum vitae and letter of application using a computer. Learners may need to be given supported workshop time on computers to develop these documents. Before attending a work experience interview, it would be appropriate for learners to role play an interview and be given feedback on their interview technique. After attending an interview, they should reflect on their performance and how they could improve their effectiveness.

In Outcome 3, learners will review their existing skills, knowledge and experience against those required for a specific job role and how they will seek to develop these during the work experience. This development will be reviewed at a mid-point during the work experience and at the end, when they will reflect on how the work experience has helped to develop their future employability in line with their employment ambitions. Whilst learners are on work experience, and especially if this is an extended placement away from the centre, it is important that they have access to and support available from tutors.

Outcome 4 requires learners to gather basic evidence on their work experience, including the organisation name, main products or services, organisation staffing structure and their role within the organisation. The learner does not need to keep a diary of all duties undertaken each day but should produce a detailed description of the usual work routine and supplement this with a diary of any additional tasks, events, activities or items that represent learning opportunities. They should also note how health and safety of staff and, if relevant, customers is managed in the workplace. A feedback report from the work experience provider will form part of the evidence for this outcome. The final report on work experience could be presented in written form or as a presentation to tutors and other learners. As a minimum, it should include the range listed. It would be appropriate to include the final review and reflection on work experience from Outcome 3 in this report.

Level: 2

Credit value: 10

Unit aim

This unit aims to provide learners with an understanding of the principles of business within the environmental and land-based sector, 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 to further education and training.

The learner will investigate the structure of one industry within the land-based sector and the principal organisations within it. They will explore regulations and legislation relevant to that industry. The learner will develop the knowledge of common business operations and the simple administrative tasks.

Learning outcomes

There are **four** learning outcomes to this unit. The learner will:

1. Know an industry within the environmental and land-based sector
2. Know the relevant legislation and codes of practice within the environmental and land-based sector
3. Know common business operations
4. Know how to carry out simple administrative tasks

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

n/a

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge

Unit 225

Environmental and Land-based Business

Outcome 1

Know an industry within the environmental and land-based sector

Assessment Criteria

The learner can:

1. Describe the **structure** of one industry within the environmental and land-based sector covering:
 - size
 - employment
 - main activities
 - geographical influence
 - economic contribution
2. Identify the **principal organisations and trade associations** within an industry in the environmental and land-based sector

Unit content

Structure

Features and characteristics of the industry, different types of businesses and organisations and the type of goods and services they provide, size of these businesses/organisations e.g. numbers employed, regional differences, allied industries (what they are, the goods and services they supply and the role they play), trends and issues currently affecting the industry

Principal organisations and trade associations

Roles and aims of key selected organisations in the industry e.g. statutory, Department for Environment, Food and Rural Affairs ((DEFRA) England), Welsh Assembly Government (Wales), Scottish Executive Environment and Rural Affairs Department (SEERAD), or Department of Agriculture and Rural Affairs (DARD (Northern Ireland), Health and Safety Executive, Department of Trade and Industry (DTI), Environment Agency, Food Standards Agency, non-governmental, major land-owning or representative e.g. The Royal Society for the Prevention of Cruelty to Animals (RSPCA), British Veterinary Association (BVA), Royal Horticultural Society (RHS), Institute of Groundsmanship (IOG), Lantra Sector Skills Council, British Horse Society (BHS), National Farmers Union (NFU), National Trust, Natural England

Unit 225

Outcome 2

Environmental and Land-based Business

Know the relevant legislation and codes of practice within the environmental and land-based sector

Assessment Criteria

The learner can:

1. Identify the main United Kingdom or European **legislation and codes of practice** relating to one industry within the environmental and land-based sector
2. Identify key requirements of current **employment law** on the environmental and land-based sector

Unit content

Legislation and codes of practice

United Kingdom legislation: consideration of the main relevant current legislation relating to an industry in the land and environment sector for example Agriculture Tenancies Act (1995), Animal Health Act (2002), Welfare of Animal (Transport) Order 2006, Animal Welfare Act 2006, Environment Protection Act 1990 (as amended 1995), Control of Pesticides Regulations 1986 (COPR), Riding Establishments Act 1970, Horse Passports (England) Regulations 2004, Control of Dogs Order 1992, Dangerous Dogs Act 1991(as amended 1997), codes of practice e.g. welfare of farm or companion animals

European legislation: relevant European directives e.g. relating to employment, the environment and the specific industry in the land and environment sector

Employment law

The main relevant current legislation relating to employment e.g. Health and Safety at Work etc Act 1974, Control of Substances Hazardous to Health Regulations (2002) (COSHH), Working Time Regulations 1998 (as amended 2002), Disability Discrimination Acts 1995 (as amended 2005), Employment Act 2002, National Minimum Wage Act 1998, Race Relations Act 1976 (as amended 2003), Sex Discrimination Act 1975

Assessment Criteria

The learner can:

1. Describe how **common IT software** can be used in everyday business operations
2. State the purpose and operation of **common business tasks**
 - financial and banking
 - marketing
 - administrative tasks

Unit content

Common IT software

Examples of business uses of: word processor (e.g. letters, notices), spreadsheets (e.g. records, timesheets), database (e.g. records), graphics (e.g. advertisements, posters), e-mails

Common business tasks

Financial and banking: taking payments by cash, cheque, debit card and credit card, ordering procedure for supplies, invoices, types of bank account (current, savings), loans, overdraft, methods of payment (debit card, cheques, bank giro credit, standing order, direct debit)

Marketing: ways to promote a business (advertisements, promotional events, referral / word of mouth, importance of customer care), preparation of promotional materials

Administrative tasks: file documents, complete simple records (e.g. production, customers), check stock levels and complete stock control records, communicate using written and electronic media, importance of security and confidentiality of business records

Unit 225

Outcome 4

Environmental and Land-based Business

Know how to carry out simple administrative tasks

Assessment Criteria

The learner can:

1. Use appropriate methods to **prepare, present, sort and retrieve information**
2. Carry out simple **accounting and administrative tasks** appropriate to the business

Unit content

Prepare, present, sort and retrieve information

Use of IT and paper filing systems, completion of simple business records, preparation of business documents (e.g. letters, advertisements)

Accounting and administrative tasks

Completion of orders, invoices, cheques, conduct stock check and complete stock records

Unit 225 Environmental and Land-based Business

Notes for guidance

This unit can be applied to any of the industries in the environmental and land-based sector, and delivery should be specifically tailored to the vocational interests of learners and the qualification being studied. They will learn about the industry and legal context in which businesses in the chosen sector takes place, and important operations necessary to manage a business.

In Outcome 1, learners will study the structure of their industry. They may be encouraged to represent graphically the range of businesses and their products/services, and also the ancillary businesses on which the primary businesses depend. They could relate these ideas to a specific business, whilst also investigating the range of businesses found locally and nationally. Learners will also find out about the principal organisations and trade associations concerned with their industry, and will investigate the roles and impact of selected organisations. They will investigate some of the key trends and issues facing their industry and how it is responding. Delivery of this outcome would be enriched by speakers from selected organisations.

Outcome 2 examines the UK and European legal framework affecting businesses in the particular land-based industry. Learners are not expected to become legal experts, but to develop an awareness of the main pieces of legislation and how they impact on business in their industry. Delivery of this outcome could be enhanced by guest speakers with experience of running a business or becoming self employed for the first time.

In Outcome 3, learners will identify how common IT software can be used to perform a range of everyday business operations. Some of these are common to all businesses (e.g. writing letters), but tutors should ensure that examples are vocationally relevant to the subject area of the learners. It would be helpful for learners to have the opportunity to practice some of the IT skills to carry out simulated business tasks. Learners should find out about day-to-day business activities involving finance and banking, but will not be expected to learn about accounts. It would help learners to have the opportunity to study a range of records (financial and non-financial) that are kept in a specific business, and how these are maintained and used.

Outcome 4 links closely with Outcome 3 and gives learners the opportunity to understand and engage in operations and tasks identified previously. This should include preparing a range of business outputs using the IT applications listed. These could relate to other items in the content, e.g. advertisements, posters, specific records appropriate to businesses in their industry. They will also complete examples of paper based records and ensure that both IT and paper records are filed appropriately.

References

Books

Carysforth, C. Neild, M. 2006. *BTEC First Business*. 2nd ed. Oxford: Butterworth Heinemann.
Canwell, D., Sutherland, J. 2006. *BTEC First Business*. Cheltenham: Nelson Thornes.

Websites

www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.bized.ac.uk	Business Education Websites
www.hse.gov.uk	Health and Safety Executive
www.dti.gov.uk	Department for Trade and Industry
www.environment-agency.gov.uk	Environment Agency
www.food.gov.uk	Food Standards Agency
www.rspca.org.uk	Royal Society for the Prevention of Cruelty to Animals
www.bva.co.uk	British Veterinary Association
www.rhs.org.uk	Royal Horticultural Society
www.iog.org.uk	Institute of Groundsmanship
www.lantra.co.uk	Lantra Sector Skills Council
www.bhs.org.uk	British Horse Society
www.nfuonline.com	National Farmers Union
www.nationaltrust.org.uk	The National Trust
www.naturalengland.org.uk	Natural England

Level: 2

Credit value: 10

Unit aim

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.

The learner will cover the basic work requirements within land-based workshops. They will understand the importance of Health and Safety as an integral topic. They will learn how to safely use hand and power tools and basic welding equipment commonly found in a land-based setting. The skills associated with these will be integrated with the development and use of basic maintenance and repair techniques.

Learning outcomes

There are **four** learning outcomes to this unit. The learner will:

1. Be able to safely use commonly found hand and power tools for the maintenance and repair of land-based machinery and installations
2. Be able to safely use basic welding and cutting equipment
3. Be able to safely use basic maintenance and/or repair techniques on land-based machinery and installations
4. Understand land-based workshop health and safety requirements

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

- CU1 Maintain safe and effective working practices
CU27 Maintain equipment and machines

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC.

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge.

Unit 226

Outcome 1

Introduction to Land-based Workshop Practice

Be able to safely use commonly found hand and power tools for the maintenance and repair of land-based machinery and installations

Assessment Criteria

The learner can:

1. Select and safely use **hand** and **power tools** to meet given objectives **maintaining** or **repairing** land-based machinery or installations
2. State **reasons** for the hand and power tools selected

Range

All learning disciplines: hand held manually operated tools to carry out basic service, maintenance and component replacement tasks

Unit content

Hand tools

Spanners, wrenches, socket sets, keys, gripping tools, drivers, punches, torque setting, pressure measurement, marking out tools, measuring devices

Power tools

Drills, metal cutters, battery/mains, electrical powered, pneumatic, hand held, bench mounted

Maintaining

Routine maintenance, periodic maintenance, wearing component replacement, tool maintenance

Repairing

Workshop based, emergency on work site, belts/pulleys, chains/sprockets, gears/shafts, bearings, bushes, seals

Reasons

Justification for selection, appropriateness, availability, safety

Unit 226

Outcome 2

Introduction to Land-based Workshop Practice

Be able to safely use basic welding and cutting equipment

Assessment Criteria

The learner can:

1. Safely use **basic welding equipment** and **materials** to produce a simple welded joint to meet given objectives
2. State reasons for the **basic welding equipment** and **materials** selected

Range

All learning disciplines: preparation and metal joining of materials up to 3mm thickness for oxy/ fuel welding and up to 8mm for MMA and MIG techniques. Lap, butt and fillet welds to a given standard, Personal Protection Equipment (PPE)

Unit content

Basic welding equipment

Oxygen, propane, acetylene gasses- canisters, bottles, safe handling and storage

Gauges, hoses and fittings- mixing torch and nozzle selection, flame types and pressures, rods, flux and techniques

Manual metal arc/inert gas welder design, input/output voltage settings, amperage settings, rods, coatings and techniques

Inert gasses/argon, wire diameter, speed, nozzles and shrouds, MIG techniques

Materials

Ferrous/ non ferrous material choices, melting temperatures, suitability for purpose

Unit 226
Outcome 3

Introduction to Land-based Workshop Practice
Be able to safely use basic maintenance and/or repair techniques on land-based machinery and installations

Assessment Criteria

The learner can:

1. Safely use **basic techniques** to **maintain** or **repair** land-based machinery or installations to meet given objectives
2. State reasons for the **basic techniques** selected

Range

All learning disciplines: carry out routine, periodic and unscheduled maintenance on machines typical to the individual's area of study for example those used for grass cutting/collection, ground preparation or cultivation, crop/materials transportation, fixed equipment/installations, PPE

Unit content

Basic maintenance techniques

Systematic routine maintenance, follow manufacturers' service charts, operator manual instructions- non routine/periodic maintenance tasks, wearing component adjustments- lubrication, pressures

Basic repair techniques

Component replacement, bearings bushes, seals, driveline components- remanufacture, brackets, guards

Unit 226
Outcome 4

Introduction to Land-based Workshop Practice
Understand land-based workshop health and safety requirements

Assessment Criteria

The learner can:

1. Explain the importance of **health and safety** in the **workshop**
2. Produce a suitable **risk assessment** for the use of hand and/or power tools to meet given objectives

Range

All learning disciplines: to be made aware of Health and Safety at Work etc Act 1974, Provision and Use of Work Equipment Regulations 1998 (PUWER), Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), Control of Substances Hazardous to Health 2002 (COSHH), first aid procedures, minor injuries and burns, fire prevention and use of fire extinguishers, Personal Protective Equipment (PPE)

Unit content

Health and safety

Safe working areas, ventilation, lighting, PPE, correct storage, electrical testing procedures, safe lifting procedures

Workshop

Designated welding, grinding areas, fume extraction, service bays, work areas on site, environmental hazards

Risk assessment

Assessing risks prior to work, injury, damage to self, others and equipment-control measures identified- recording and storing information

Unit 226 Introduction to Land-based Workshop Practice

Notes for guidance

This unit is designed to provide the learner with the knowledge, understanding and practical skills required to maintain a range of machines and equipment used in land-based operations. The maintenance tasks may be scheduled as periodic- daily, weekly, monthly or yearly or routine, where it is expected the machine is inspected at regular intervals during work to ensure efficiencies. Unscheduled repairs may need to be carried out in the event of breakdowns. These repairs may have to be carried out on site. Emphasis will be on safe and efficient working practices throughout the unit.

Health and safety - Centres and tutors need to be aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the operation of equipment and machinery is involved. This unit requires the learner to undertake equipment and machinery operations under close supervision, and this is the same for any unit within the qualification that requires the learner to operate or use machinery. This is a largely practical-based unit which looks at the basic use and maintenance of hand and power tools and equipment and machinery. There is significant emphasis on safe practices throughout the unit. Throughout the unit the emphasis is on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In Outcome 1, the learner will be required to identify appropriate tools needed to perform basic maintenance and repair techniques to meet given objectives. The learner should be able to demonstrate correct and safe use of chosen tools, explain limitations and suggest alternative strategies. Delivery should also include the care and maintenance of tools.

In Outcome 2, the learner will become familiar with a range of thermal metal joining techniques and equipment needed to carry out welding tasks to meet given objectives. It is anticipated that delivery of this unit will be largely practical. As part of this outcome, the learner should be able to recognise different materials and their properties and have an understanding of alternative welding/repair strategies. Welding is potentially dangerous so particular emphasis should be placed on safe working practices.

In Outcome 3, the learner will be required to demonstrate acceptable safe working practices whilst repairing and maintaining machines and equipment. A range of tasks should be covered to include both maintenance and repair techniques. A portfolio of records for each task should contribute towards assessment material. It is expected that some tasks may have several acceptable strategies and the learner will be expected to justify the chosen strategy.

Outcome 4 the learner is expected to demonstrate understanding of health and safety procedures in the workshop and carry out risk assessments. As part of this outcome the learner should carry out an inspection to the work premises and equipment to highlight any hazards, risks or discrepancies which may impair safe working practices. The risk assessments throughout this unit may contribute to the assessment evidence for this outcome.

References

Books

Gourd L, 1995. *Principles of Welding Technology*, 3rd edition Butterworth-Heinemann ISBN 0340613998
Kenyon W, 1987. *Basic Welding and Fabrication*, 2nd edition, Longman ISBN 0582005361.

Websites

www.hse.gov.uk Health and Safety Executive

Level: 2

Credit value: 10

Unit aim

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.

The learner will be able to develop the skills and knowledge to select, prepare, operate, and maintain a range of land-based equipment and machines appropriate to their area of study. The learner will also cover the health and safety requirements associated with the use and maintenance of machines.

Learning outcomes

There are **four** learning outcomes to this unit. The learner will:

1. Understand safe working principles when using equipment and machinery
2. Be able to prepare land-based equipment and machinery for use
3. Be able to operate land-based equipment and machinery
4. Be able to maintain land-based equipment and machinery

Guided learning hours

It is recommended that **60** hours should be allocated for this unit. This may be on a full-time or part-time basis.

Details of the relationship between the unit and relevant national occupational standards

CU27 Maintain equipment and machines

L27 Use and maintain non-powered and hand held powered tools and equipment.

Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra SSC

Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge

Unit 227

Outcome 1

Introduction to Land-based Machinery Operations

Understand safe working principles when using equipment and machinery

Assessment Criteria

The learner can:

1. Select **appropriate equipment** for land-based tasks
2. Explain why **manufacturers' instructions** should be followed when working with land-based equipment and machines
3. Explain the **legal and environmental requirements** associated with specific machines
4. Identify the **controls/devices/instruments** and other health and safety requirements for machinery and equipment

Range

Agriculture

As appropriate from:

Types: powered and powered machines, tractor mounted, trailed or self propelled, seeding/ planting equipment

Purposes: seedbed preparation, crop harvesting, materials application, liquids, solids, granules, powders

Horticulture/Landscape

As appropriate from:

Types: non powered tools and equipment, hand held power tools, pedestrian controlled machines, ride on machines

Purposes: ground preparation, grass cutting and collection, materials application, liquids, granules, powders, pelleting, chipping, shredding

Unit content

Appropriate equipment

As outlined above, selection, fit for purpose, ground conditions, suitability for scale of work, training/certification requirements

Manufacturers' instruction

Dealer installation process, operator instruction manuals, manufacturer web sites

Legal and environmental requirements

Health and Safety at Work etc Act 1974 (HASWA), Provision and Use of Work Equipment Regulations 1998 (PUWER), Lifting Operations and Lifting Equipment Regulations 1998 (LOLER Control of Substances Hazardous to Health Regulations (2002) (COSHH), Control of Pesticides Regulations 1986 (COPR), Environmental contamination, Personal Protective Equipment (PPE)

Controls/devices/instruments

Operator controls, power unit controls, manual, hydraulic, electronic, machine adjustment/performance settings - safe start devices, clutches, performance/load limiters, seat occupation switches, guards – warning lights, analogue/digital information

Unit 227

Outcome 2

Introduction to Land-Based Machinery Operations

Be able to prepare land-based equipment and machinery for use

Assessment Criteria

The learner can:

1. Carry out **adjustments** on land-based equipment and machines to meet specific requirements prior to use
2. Explain the **benefits** of correct adjustment of equipment and machines
3. Carry out **pre-start checks**, including **fuelling**

Range

Agriculture

As appropriate from:

Types: powered and powered machines, tractor mounted, trailed or self propelled, seeding/ planting equipment

Purposes: seedbed preparation, crop harvesting, materials application, liquids, solids, granules, powders

Horticulture/Landscape

As appropriate from:

Types: non powered tools and equipment, hand held power tools, pedestrian controlled machines, ride on machines

Purposes: ground preparation, grass cutting and collection, materials application, liquids, granules, powders, pelleting, chipping, shredding

Unit content

Adjustments

Operator fit, working height/depth/speed/calibration/tilth/work rate

Benefits

Specific work rates/outputs achieved, power/fuel consumption, risk of premature wear/damage to equipment, operator fatigue

Pre-start checks

Lubricants, cooling, fuel level, wheel equipment, safety guards, road legal, machine/vehicle security, PPE

Fuelling

Fuel types, fuel contamination checks, correct storage, machine power isolation, ventilation, spillage, safe areas, fire hazards, PPE

Unit 227

Outcome 3

Introduction to Land-Based Machinery Operations

Be able to operate land-based equipment and machinery

Assessment Criteria

The learner can:

1. **Operate** equipment and machines safely and **efficiently** for different land-based activities
2. Carry out activities to achieve the **desired results** when operating land-based equipment and machines

Range

Agriculture

As appropriate from:

Types: powered and powered machines, tractor mounted, trailed or self propelled, seeding/ planting equipment

Purposes: seedbed preparation, crop harvesting, materials application, liquids, solids, granules, powders

Horticulture/Landscape

As appropriate from:

Types: non powered tools and equipment, hand held power tools, pedestrian controlled machines, ride on machines

Purposes: ground preparation, grass cutting and collection, materials application, liquids, granules, powders, pelleting, chipping, shredding

Unit content

Operate

Attachment to power unit, engagement of power, assess test runs and re-adjust, site assessment for hazards/risks, continuous monitoring of performance, over/under lapping

Efficiency

Acceptable work rates, back up power availability, economy of fuel, wearing component lifespan

Desired results

All area covered, correct application rates/tilth of seedbed, quality of cut, avoid undesirable results (compaction of soil, wheel marks in seedbed)

Unit 227

Outcome 4

Introduction to Land-Based Machinery Operations

Be able to maintain land-based equipment and machinery

Assessment Criteria

The learner can:

1. Identify **routine maintenance** for land-based equipment and machines using manufacturers' instructions
2. Identify **hazards** and comply with risk assessments **during maintenance activities**
3. Carry out different **routine maintenance activities** safely on a range of equipment and machines
4. **Record maintenance activities** in an **appropriate format**

Range

Agriculture

As appropriate from:

Types: powered and powered machines, tractor mounted, trailed or self propelled, seeding/ planting equipment

Purposes: seedbed preparation, crop harvesting, materials application, liquids, solids, granules, powders

Horticulture/Landscape

As appropriate from:

Types: non powered tools and equipment, hand held power tools, pedestrian controlled machines, ride on machines

Purposes: ground preparation, grass cutting and collection, materials application, liquids, granules, powders, pelleting, chipping, shredding

Unit content

Routine maintenance

Pre-work assessment of machine condition, routine/periodic maintenance, adjustments for wear, lubrication, replacement components, preparation for storage, cleaning, lubrication and protection

Hazards during maintenance activities

Identify hazards according to operations

Record maintenance activities

Complete maintenance record sheet/job cards, record service/maintenance interval/date/work done, record replacement of wearing components, working life

Appropriate format

Manufacturers documentation, service record book, service record charts, company procedures, electronic record storage, service interval label on machine

Unit 227 Introduction to Land-based Machinery Operations

Notes for guidance

This unit is designed for learners who will be given responsibility for field/groundwork using machines typical to their area of study. The unit will provide learners with knowledge and understanding, operational skills and service procedures to prepare, use, maintain and store machines and equipment. Throughout the unit the emphasis will be on acceptable health and safety procedures and safe working practices. It is expected that where tractor mounted machines are to be utilised, prior learning on tractor operations will have been assessed to ensure the learner has reached an acceptable level of skills and knowledge.

The range covered during delivery should include electric vehicles and machinery.

Health and safety - Centres and tutors aware of the need to safeguard learners, particularly in relation to pre-16 learners, when delivering and assessing units where the operation of machinery is involved. This unit requires the learner to undertake machinery operations under close supervision, and this is the same for any unit within the qualification that requires the learner to operate or use machinery. This is a largely practical-based unit which looks at the basic preparation, operation and maintenance of equipment and machinery. There is significant emphasis on safe practices throughout the unit and reference to risk assessment in learning outcome 4. Throughout the unit the emphasis is on acceptable health and safety procedures and safe working practices. The guidance in this unit requires that Health and Safety must be strictly enforced and repeated throughout. The HSE guidance AS10 'Preventing Accidents to Children on Farms' provides practical guidance on how to reduce the risk of injury to children under 13 and older children below the minimum school leaving age (usually 16).

In Outcome 1 the learner will be able to select a suitable item of equipment to perform a range of land-based tasks to achieve given outcomes. The learner will be able to understand basic working principles of the equipment and any environmental and legal issues relating to the machines' use. Manufacturers' instructions are to be followed at all times to interpret operator controls and instrumentation information.

In Outcome 2 the learner is expected to demonstrate skills in the use of machines and equipment used in the area of their study. This may entail operator set up, connection to power source and initial setting prior to moving on site. Where tractor trailed, mounted or self propelled equipment is to be used an understanding of safe fuelling and transportation must be demonstrated. With ever-increasing costs on fuel, wearing components and operator time, an understanding of the benefits of correct operating procedures, setting linked to work rate targets must be understood.

In Outcome 3 the learner needs to be aware of a range of machine capabilities to achieve specified performance criteria. These may be work rate targets, quality of work, height/depth of work or delivery rates. Field/site procedures need to be correctly chosen where subsequent operations are to follow. Seeding requires a specific depth of seedbed, a fineness of tilth to suit seed type, minimum seedbed compaction with no wheel marks evident.

In Outcome 4 the learner must be able to identify from the manufacturers' instructions, and demonstrate maintenance requirements and procedures. Where power sources are used, maintenance of those sources will need to be identified. Risks of injury/damage to self, others, the environment or equipment need to be identified by the learner and control measures put in place prior to commencement of any maintenance tasks. To enable evaluations and costings to be done an accurate record of work, maintenance and replacement parts must be recorded. This may also be of benefit where warranty procedures are to be implemented to recoup costs of breakdowns.

References

Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN: 1-903-36668-2.

Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN: 0-632-03159-X.

Journals

Horticultural Weekly

Profi International

Manufacturers publications and manuals

Lubrication charts and data sheets

Websites

www.bagma.com

British Agricultural and Garden Machinery Association

www.defra.gov.uk

Dept for Environment, Food and Rural Affairs

www.wales.gov.uk

Welsh Assembly Government

www.scotland.gov.uk

Scottish Executive Environment and Rural Affairs

Department

www.dardni.gov.uk

Department of Agriculture and Rural Affairs

(Northern Ireland)

www.hse.gov.uk

Health and Safety Executive

Appendix 1 Relationships to other qualifications

Literacy, language, numeracy and ICT skills development

These qualifications include opportunities to develop and practise many of the skills and techniques required for success in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills Wales - www.cityandguilds.com/esw

There might also be opportunities to develop skills and/or portfolio evidence if learners are completing any Key Skills alongside these qualifications.

Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on www.cityandguilds.com.

Providing City & Guilds qualifications – a guide to centre and qualification approval contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of learners
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Ensuring quality contains updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document contains information on:

- Management systems
- Maintaining records
- Assessment
- Internal verification and quality assurance
- External verification.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for learners who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- ***Walled Garden***
Find out how to register and certificate learners on line
- ***Qualifications and Credit Framework (QCF)***
Contains general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- ***Events***
Contains dates and information on the latest Centre events

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Useful contacts

Type	Contact	Query
UK learners	T: +44 (0)84 4543 0033 E: learnersupport@cityandguilds.com	<ul style="list-style-type: none">• General qualification information
Centres	T: +44 (0)84 4543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com	<ul style="list-style-type: none">• Exam entries• Registrations/enrolment• Certificates• Invoices• Missing or late exam materials• Nominal roll reports• Results
Walled Garden	T: +44 (0)84 4543 0000 F: +44 (0)20 7294 2405 E: walledgarden@cityandguilds.com	<ul style="list-style-type: none">• Re-issue of password or username• Technical problems• Entries• Results• GOLLA• Navigation• User/menu option problems
Employer	T: +44 (0)121 503 8993 E: business_unit@cityandguilds.com	<ul style="list-style-type: none">• Employer solutions• Mapping• Accreditation• Development Skills• Consultancy

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