

**City & Guilds Level 3 Certificate,  
Subsidiary Diploma, 90-Credit  
Diploma, Diploma, Extended  
Diploma in Land-based Technology  
(0075-03)**



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March 2022  
Version 3.1

**Qualification handbook for centres**

**501/0693/4**

**501/0694/6**

**600/5945/X**

**501/0681/8**

**501/0682/X**

A large graphic at the bottom of the page. It features a central blue sunburst or starburst pattern with multiple rays extending outwards. Overlaid on this pattern is the text "LAND-BASED MACHINERY" in a bold, white, sans-serif font. The text is set against a dark blue, 3D-style rectangular background that has a slight shadow and perspective, making it appear to float above the sunburst.

**LAND-BASED  
MACHINERY**

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As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

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# City & Guilds (0075-03)

## Qualification handbook for centres



Qualification title	Number	QAN
City & Guilds Level 3 Certificate in Land-based Technology	0075-03	501/0693/4
City & Guilds Level 3 Subsidiary Diploma in Land-based Technology	0075-03	501/0694/6
City & Guilds Level 3 90-Credit Diploma in Land-based Technology	0075-03	600/5945/X
City & Guilds Level 3 Diploma in Land-based Technology	0075-03	501/0681/8
City & Guilds Level 3 Extended Diploma in Land-based Technology	0075-03	501/0682/X

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# Contents

<b>1</b>	<b>Introduction to the qualifications</b>	<b>7</b>
1.1	Qualification structure	8
1.2	Opportunities for progression	26
1.3	Qualification support materials	26
<b>2</b>	<b>Centre requirements</b>	<b>27</b>
2.1	Resource requirements	27
2.2	Learner entry requirements	28
2.3	Age restrictions	28
<b>3</b>	<b>Course design and delivery</b>	<b>29</b>
3.1	Initial assessment and induction	29
3.2	Recommended delivery strategies	29
<b>4</b>	<b>Assessment</b>	<b>30</b>
4.1	Summary of assessment methods	30
4.2	Assignments	30
4.3	Recognition of prior learning (RPL)	30
4.4	Resubmission of Assignments	30
<b>5</b>	<b>Units</b>	<b>31</b>
<b>6</b>	<b>Registration and Certification</b>	<b>34</b>
<b>Unit 301</b>	<b>Land-based Engineering Operations – Service and Repair Engines and Components</b>	<b>38</b>
<b>Unit 302</b>	<b>Understanding and Servicing Mechanical Power Transmission Systems</b>	<b>45</b>
<b>Unit 303</b>	<b>Understanding Health, Safety and Welfare in the Land-based Engineering Workplace</b>	<b>52</b>
<b>Unit 304</b>	<b>Service and Repair Hydraulic Systems and Components on Land-based Equipment</b>	<b>59</b>
<b>Unit 305</b>	<b>Understanding Land-based Vehicle Chassis Systems</b>	<b>65</b>
<b>Unit 306</b>	<b>Undertake and Review Work Related Experience in the Land-based Industries</b>	<b>72</b>
<b>Unit 307</b>	<b>Understanding and Working with Land-based Vehicle Engine Technology</b>	<b>79</b>
<b>Unit 308</b>	<b>Inspect and Test Land-based Machinery and Equipment</b>	<b>86</b>
<b>Unit 309</b>	<b>Undertaking Land-based Workshop Practice</b>	<b>93</b>
<b>Unit 310</b>	<b>Maintain Electronic Control and Monitoring Systems on Land-based Equipment</b>	<b>101</b>
<b>Unit 311</b>	<b>Service and Repair Suspension Systems on Land-based Equipment</b>	<b>108</b>
<b>Unit 312</b>	<b>Service and Repair Pneumatic Systems and Components for Land-based Equipment</b>	<b>113</b>
<b>Unit 313</b>	<b>Service and Repair Powershift, Hydrostatic and CVT Transmissions on Land-based Equipment</b>	<b>118</b>
<b>Unit 314</b>	<b>Monitor the Handover and Installation of Land-based Equipment</b>	<b>123</b>
<b>Unit 315</b>	<b>Operate and Service Land-based Vehicle Transmission Systems</b>	<b>128</b>
<b>Unit 316</b>	<b>Undertaking Land-based Machinery Operation</b>	<b>135</b>
<b>Unit 317</b>	<b>Understanding and Working with Land-based Repair Processes and Materials Technology</b>	<b>142</b>
<b>Unit 318</b>	<b>Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)</b>	<b>148</b>
<b>Unit 319</b>	<b>Understanding and Servicing Land-based Harvesting Machinery (Processing)</b>	<b>155</b>

<b>Unit 320</b>	<b>Working with Land-based Construction Plant Materials Handling Equipment</b>	<b>162</b>
<b>Unit 321</b>	<b>Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment</b>	<b>169</b>
<b>Unit 322</b>	<b>Working with Land-based Diesel Fuel Injection Systems</b>	<b>176</b>
<b>Unit 323</b>	<b>Undertaking Land-based Technology Engineering Drawing</b>	<b>183</b>
<b>Unit 324</b>	<b>Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)</b>	<b>189</b>
<b>Unit 325</b>	<b>Working with Land-based Machinery (Application Equipment)</b>	<b>196</b>
<b>Unit 326</b>	<b>Working with Land-based Tool Hire Machinery and Mechanisms</b>	<b>203</b>
<b>Unit 327</b>	<b>Understanding and Working with Groundcare Equipment</b>	<b>211</b>
<b>Unit 328</b>	<b>Undertaking 4WD Vehicle Maintenance, Operation and Recovery</b>	<b>218</b>
<b>Unit 329</b>	<b>Familiarisation and Management of Land-based Vehicles</b>	<b>224</b>
<b>Unit 330</b>	<b>Understanding Computer Application and Control in Land-based Technology</b>	<b>231</b>
<b>Unit 331</b>	<b>Understanding Land-based Machinery Management</b>	<b>238</b>
<b>Unit 332</b>	<b>Business Management in the Land-based Sector</b>	<b>245</b>
<b>Unit 333</b>	<b>Undertake an Investigative Project in the Land-based Sector</b>	<b>252</b>
<b>Unit 334</b>	<b>Applications of Science in Land-based Engineering</b>	<b>259</b>
<b>Unit 335</b>	<b>Undertake Retail Merchandising for the Land-based Sector</b>	<b>263</b>
<b>Unit 336</b>	<b>Undertaking Specialised Land-based Workshop Practices</b>	<b>270</b>
<b>Unit 337</b>	<b>Refrigerant Handling</b>	<b>276</b>
<b>Unit 338</b>	<b>Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment</b>	<b>280</b>
<b>Unit 339</b>	<b>Recognise and Reduce Risks in the Land-based Engineering Work Area</b>	<b>287</b>
<b>Unit 340</b>	<b>Land-based Engineering Operations – Perform Thermal Joining Processes</b>	<b>291</b>
<b>Unit 341</b>	<b>Participate in Business Planning and Improvement in the Land-based Sector</b>	<b>297</b>
<b>Unit 207</b>	<b>Provide Customer Care within Land-based Engineering Operations</b>	<b>303</b>
<b>Unit 208</b>	<b>Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes</b>	<b>308</b>
<b>Unit 220</b>	<b>Service and Repair Electrical Systems on Land-based Equipment</b>	<b>314</b>
<b>Unit 223</b>	<b>Land-based Engineering Operations – Use Calculations</b>	<b>320</b>
<b>Appendix 1</b>	<b>Relationships to other qualifications</b>	<b>326</b>
<b>Appendix 2</b>	<b>Sources of general information</b>	<b>327</b>

# 1 Introduction to the qualifications

Qualification title and level	City & Guilds qualification number	Qualification accreditation number
Level 3 Certificate in Land-based Technology	0075-03	501/0693/4
Level 3 Subsidiary Diploma in Land-based Technology	0075-03	501/0694/6
Level 3 90-Credit Diploma in Land-based Technology	0075-03	600/5945/X
Level 3 Diploma in Land-based Technology	0075-03	501/0681/8
Level 3 Extended Diploma in Land-based Technology	0075-03	501/0682/X

## Qualification summary

Qualification title and level	Credits	Guided Learning Hours	Total Qualification Time (TQT)
Level 3 Certificate in Land-based Technology	30	180	300
Level 3 Subsidiary Diploma in Land-based Technology	60	360	600
Level 3 90-Credit Diploma in Land-based Technology	90	540	900
Level 3 Diploma in Land-based Technology	120	720	1200
Level 3 Extended Diploma in Land-based Technology	180	1080	1800

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 3 Certificate, Subsidiary Diploma and Diploma in Land-based Technology have been approved as SL by the Environmental and Land-based Diploma DDP and Ofqual for the Advanced Diploma in Environmental and Land-based Studies. They have been designed to:

- complement principal learning within the Advanced 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 technology 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

## 1.1 Qualification structure

### City & Guilds Level 3 Certificate

To achieve the **Level 3 Certificate in Land-based Technology**, learners must achieve 30 credits from any combination of optional group units in the table below.

Unit accreditation number	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
H/600/3437	301	Land-based Engineering Operations – Service and Repair Engines and Components	Optional	10
M/601/4263	302	Understanding and Servicing Mechanical Power Transmission Systems	Optional	10
L/601/4271	303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	Optional	10
H/600/3440	304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Optional	5
M/601/4280	305	Understanding Land-based Vehicle Chassis Systems	Optional	10
J/601/4267	307	Understanding and Working with Land-based Vehicle Engine Technology	Optional	10
A/600/3444	308	Inspect and Test Land-based Machinery and Equipment	Optional	10
M/600/9631	309	Undertaking Land-based Workshop Practice	Optional	10
M/600/3439	310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	Optional	10
K/600/3438	311	Service and Repair Suspension Systems on Land-based Equipment	Optional	5
K/600/3441	312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5
M/600/3442	313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	Optional	10



T/600/3443	314	Monitor the Handover and Installation of Land-based Equipment	Optional	5
L/601/4254	315	Operate and Service Land-based Vehicle Transmission Systems	Optional	10
H/600/9805	316	Undertaking Land-based Machinery Operations	Optional	10
Y/601/4256	317	Understand and Work with Land-based Repair Processes and Materials Technology	Optional	10
K/601/4259	318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	Optional	10
D/601/4260	319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	Optional	10
Y/601/4287	320	Working with Land-based Construction Plant Materials Handling Equipment	Optional	10
L/601/4285	321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	Optional	10
D/601/4288	322	Working with Land-based Diesel Fuel Injection Systems	Optional	10
J/601/4284	323	Undertaking Land-based Technology Engineering Drawing	Optional	10
K/601/4262	324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	Optional	10
H/601/4289	325	Working with Land-based Machinery (Application Equipment)	Optional	10
Y/601/4290	326	Working with Land-based Tool Hire Machinery and Mechanisms	Optional	10
T/601/4264	327	Understanding and Working with Groundcare Equipment	Optional	10
T/601/4284	328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	Optional	10

F/601/4252	329	Familiarisation and Management of Land-based Vehicles	Optional	10
J/601/4270	330	Understanding Computer Application and Control in Land-based Technology	Optional	10
Y/601/4273	331	Understanding Land-based Machinery Management	Optional	10
A/600/3427	208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10

## City & Guilds Level 3 Subsidiary Diploma

To achieve the **City & Guilds Level 3 Subsidiary Diploma in Land-based Technology**, learners are required to achieve 25 credits in the Mandatory group. A further 35 credits are required from the Optional group units in the table below. A total of 60 credits are required to achieve this qualification.

Unit accreditation number	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
H/600/3437	301	Land-based Engineering Operations – Service and Repair Engines and Components	Mandatory	10
M/601/4263	302	Understanding and Servicing Mechanical Power Transmission Systems	Optional	10
L/601/4271	303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	Mandatory	10
H/600/3440	304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Mandatory	5
M/601/4280	305	Understanding Land-based Vehicle Chassis Systems	Optional	10
R/600/9394	306	Undertake and Review Work Related Experience in the Land-based Industries	Optional	10
J/601/4267	307	Understanding and Working with Land-based Vehicle Engine Technology	Optional	10
A/600/3444	308	Inspect and Test Land-based Machinery and Equipment	Optional	10
M/600/9631	309	Undertaking Land-based Workshop Practice	Optional	10
M/600/3439	310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	Optional	10
K/600/3438	311	Service and Repair Suspension Systems on Land-based Equipment	Optional	5
K/600/3441	312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5

M/600/3442	313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	Optional	10
T/600/3443	314	Monitor the Handover and Installation of Land-based Equipment	Optional	5
L/601/4254	315	Operate and Service Land-based Vehicle Transmission Systems	Optional	10
H/600/9805	316	Undertaking Land-based Machinery Operations	Optional	10
Y/601/4256	317	Understand and Work with Land-based Repair Processes and Materials Technology	Optional	10
K/601/4259	318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	Optional	10
D/601/4260	319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	Optional	10
Y/601/4287	320	Working with Land-based Construction Plant Materials Handling Equipment	Optional	10
L/601/4285	321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	Optional	10
D/601/4288	322	Working with Land-based Diesel Fuel Injection Systems	Optional	10
J/601/4284	323	Undertaking Land-based Technology Engineering Drawing	Optional	10
K/601/4262	324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	Optional	10
H/601/4289	325	Working with Land-based Machinery (Application Equipment)	Optional	10
Y/601/4290	326	Working with Land-based Tool Hire Machinery and Mechanisms	Optional	10
T/601/4264	327	Understanding and Working with Groundcare Equipment	Optional	10

T/601/4284	328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	Optional	10
F/601/4252	329	Familiarisation and Management of Land-based Vehicles	Optional	10
J/601/4270	330	Understanding Computer Application and Control in Land-based Technology	Optional	10
Y/601/4273	331	Understanding Land-based Machinery Management	Optional	10
L/601/5307	339	Recognise and Reduce Risks in the Land-based Engineering Workplace	Optional	5
A/600/3427	208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10

## City & Guilds Level 3 90-Credit Diploma

To achieve the **City & Guilds Level 3 90-Credit Diploma in Land-based Technology**, learners are required to achieve 25 credits in the Mandatory group. A further 65 credits are required from the Optional group units in the table below. A total of 90 credits are required to achieve this qualification.

<b>Unit accreditation number</b>	<b>City &amp; Guilds unit number</b>	<b>Unit title</b>	<b>Mandatory/ optional for full qualification</b>	<b>Credit value</b>
H/600/3437	301	Land-based Engineering Operations – Service and Repair Engines and Components	Mandatory	10
M/601/4263	302	Understanding and Servicing Mechanical Power Transmission Systems	Optional	10
L/601/4271	303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	Mandatory	10
H/600/3440	304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Mandatory	5
M/601/4280	305	Understanding Land-based Vehicle Chassis Systems	Optional	10
R/600/9394	306	Undertake and Review Work Related Experience in the Land-based Industries	Optional	10
J/601/4267	307	Understanding and Working with Land-based Vehicle Engine Technology	Optional	10
A/600/3444	308	Inspect and Test Land-based Machinery and Equipment	Optional	10
M/600/9631	309	Undertaking Land-based Workshop Practice	Optional	10
M/600/3439	310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	Optional	10
K/600/3438	311	Service and Repair Suspension Systems on Land-based Equipment	Optional	5

K/600/3441	312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5
M/600/3442	313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	Optional	10
T/600/3443	314	Monitor the Handover and Installation of Land-based Equipment	Optional	5
L/601/4254	315	Operate and Service Land-based Vehicle Transmission Systems	Optional	10
H/600/9805	316	Undertaking Land-based Machinery Operations	Optional	10
Y/601/4256	317	Understand and Work with Land-based Repair Processes and Materials Technology	Optional	10
K/601/4259	318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	Optional	10
D/601/4260	319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	Optional	10
Y/601/4287	320	Working with Land-based Construction Plant Materials Handling Equipment	Optional	10
L/601/4285	321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	Optional	10
D/601/4288	322	Working with Land-based Diesel Fuel Injection Systems	Optional	10
J/601/4284	323	Undertaking Land-based Technology Engineering Drawing	Optional	10
K/601/4262	324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	Optional	10
H/601/4289	325	Working with Land-based Machinery (Application Equipment)	Optional	10

Y/601/4290	326	Working with Land-based Tool Hire Machinery and Mechanisms	Optional	10
T/601/4264	327	Understanding and Working with Groundcare Equipment	Optional	10
T/601/4284	328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	Optional	10
F/601/4252	329	Familiarisation and Management of Land-based Vehicles	Optional	10
J/601/4270	330	Understanding Computer Application and Control in Land-based Technology	Optional	10
Y/601/4273	331	Understanding Land-based Machinery Management	Optional	10
M/600/9709	332	Business Management in the Land-based Sector	Optional	10
M/601/0021	333	Undertake an Investigative Project in the Land-based Sector	Optional	10
T/601/4250	334	Applications of Science in Land-based Engineering	Optional	5
A/600/9812	335	Undertake Retail Merchandising for the Land-based Sector	Optional	10
J/600/9635	336	Undertaking Specialised Land-based Workshop Practices	Optional	10
L/601/5310	337	Refrigerant Handling	Optional	2
F/601/5305	338	Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment	Optional	3
L/601/5307	339	Recognise and Reduce Risks in the Land-based Engineering Workplace	Optional	5
D/600/3436	340	Land-based Engineering Operations – Perform Thermal Joining Processes	Optional	5



F/600/9701	341	Participate in Business Planning and Improvement in the Land-based Sector	Optional	10
Y/600/3435	207	Provide Customer Care within Land-based Engineering Operations	Optional	5
A/600/3427	208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
Y/600/3404	220	Service and Repair Electrical Systems on Land-based Equipment	Optional	10

## City & Guilds Level 3 Diploma

To achieve the **City & Guilds Level 3 Diploma in Land-based Technology**, learners are required to achieve 35 credits in the Mandatory group. A further 85 credits are required from the Optional group units in the table below. Units 337 and 338 must be taken in conjunction with each other if selected. A total of 120 credits are required to achieve this qualification.

<b>Unit accreditation number</b>	<b>City &amp; Guilds unit number</b>	<b>Unit title</b>	<b>Mandatory/ optional for full qualification</b>	<b>Credit value</b>
H/600/3437	301	Land-based Engineering Operations – Service and Repair Engines and Components	Mandatory	10
M/601/4263	302	Understanding and Servicing Mechanical Power Transmission Systems	Optional	10
L/601/4271	303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	Mandatory	10
H/600/3440	304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Mandatory	5
M/601/4280	305	Understanding Land-based Vehicle Chassis Systems	Mandatory	10
R/600/9394	306	Undertake and Review Work Related Experience in the Land-based Industries	Optional	10
J/601/4267	307	Understanding and Working with Land-based Vehicle Engine Technology	Optional	10
A/600/3444	308	Inspect and Test Land-based Machinery and Equipment	Optional	10
M/600/9631	309	Undertaking Land-based Workshop Practice	Optional	10
M/600/3439	310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	Optional	10
K/600/3438	311	Service and Repair Suspension Systems on Land-based Equipment	Optional	5
K/600/3441	312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5

M/600/3442	313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	Optional	10
T/600/3443	314	Monitor the Handover and Installation of Land-based Equipment	Optional	5
L/601/4254	315	Operate and Service Land-based Vehicle Transmission Systems	Optional	10
H/600/9805	316	Undertaking Land-based Machinery Operations	Optional	10
Y/601/4256	317	Understand and Work with Land-based Repair Processes and Materials Technology	Optional	10
K/601/4259	318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	Optional	10
D/601/4260	319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	Optional	10
Y/601/4287	320	Working with Land-based Construction Plant Materials Handling Equipment	Optional	10
L/601/4285	321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	Optional	10
D/601/4288	322	Working with Land-based Diesel Fuel Injection Systems	Optional	10
J/601/4284	323	Undertaking Land-based Technology Engineering Drawing	Optional	10
K/601/4262	324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	Optional	10
H/601/4289	325	Working with Land-based Machinery (Application Equipment)	Optional	10
Y/601/4290	326	Working with Land-based Tool Hire Machinery and Mechanisms	Optional	10

T/601/4264	327	Understanding and Working with Groundcare Equipment	Optional	10
T/601/4284	328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	Optional	10
F/601/4252	329	Familiarisation and Management of Land-based Vehicles	Optional	10
J/601/4270	330	Understanding Computer Application and Control in Land-based Technology	Optional	10
Y/601/4273	331	Understanding Land-based Machinery Management	Optional	10
M/600/9709	332	Business Management in the Land-based Sector	Optional	10
M/601/0021	333	Undertake an Investigative Project in the Land-based Sector	Optional	10
T/601/4250	334	Applications of Science in Land-based Engineering	Optional	5
A/600/9812	335	Undertake Retail Merchandising for the Land-based Sector	Optional	10
J/600/9635	336	Undertaking Specialised Land-based Workshop Practices	Optional	10
L/601/5310	337	Refrigerant Handling	Optional	2
F/601/5305	338	Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment	Optional	3
L/601/5307	339	Recognise and Reduce Risks in the Land-based Engineering Work Area	Optional	5
D/600/3436	340	Land-based Engineering Operations – Perform Thermal Joining Processes	Optional	5
F/600/9701	341	Participate in Business Planning and Improvement in the Land-based Sector	Optional	10

Y/600/3435	207	Provide Customer Care within Land-based Engineering Operations	Optional	5
A/600/3427	208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
Y/600/3404	220	Service and Repair Electrical Systems on Land-based Equipment	Optional	10

## City & Guilds Level 3 Extended Diploma

To achieve the **City & Guilds Level 3 Extended Diploma in Land-based Technology**, learners are required to achieve 75 credits from the Mandatory group. A further 105 credits are required from the Optional group units in the table below. Units 337 and 338 must be taken in conjunction with each other if selected. A total of 180 credits are required to achieve this qualification.

<b>Unit accreditation number</b>	<b>City &amp; Guilds unit number</b>	<b>Unit title</b>	<b>Mandatory/ optional for full qualification</b>	<b>Credit value</b>
H/600/3437	301	Land-based Engineering Operations – Service and Repair Engines and Components	Mandatory	10
M/601/4263	302	Understanding and Servicing Mechanical Power Transmission Systems	Optional	10
L/601/4271	303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	Mandatory	10
H/600/3440	304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	Mandatory	5
M/601/4280	305	Understanding Land-based Vehicle Chassis Systems	Mandatory	10
R/600/9394	306	Undertake and Review Work Related Experience in the Land-based Industries	Mandatory	10
J/601/4267	307	Understanding and Working with Land-based Vehicle Engine Technology	Mandatory	10
A/600/3444	308	Inspect and Test Land-based Machinery and Equipment	Mandatory	10
M/600/9631	309	Undertaking Land-based Workshop Practice	Mandatory	10
M/600/3439	310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	Optional	10
K/600/3438	311	Service and Repair Suspension Systems on Land-based Equipment	Optional	5
K/600/3441	312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	Optional	5

M/600/3442	313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	Optional	10
T/600/3443	314	Monitor the Handover and Installation of Land-based Equipment	Optional	5
L/601/4254	315	Operate and Service Land-based Vehicle Transmission Systems	Optional	10
H/600/9805	316	Undertaking Land-based Machinery Operations	Optional	10
Y/601/4256	317	Understand and Work with Land-based Repair Processes and Materials Technology	Optional	10
K/601/4259	318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	Optional	10
D/601/4260	319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	Optional	10
Y/601/4287	320	Working with Land-based Construction Plant Materials Handling Equipment	Optional	10
L/601/4285	321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	Optional	10
D/601/4288	322	Working with Land-based Diesel Fuel Injection Systems	Optional	10
J/601/4284	323	Undertaking Land-based Technology Engineering Drawing	Optional	10
K/601/4262	324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	Optional	10
H/601/4289	325	Working with Land-based Machinery (Application Equipment)	Optional	10
Y/601/4290	326	Working with Land-based Tool Hire Machinery and Mechanisms	Optional	10

T/601/4264	327	Understanding and Working with Groundcare Equipment	Optional	10
T/601/4281	328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	Optional	10
F/601/4252	329	Familiarisation and Management of Land-based Vehicles	Optional	10
J/601/4270	330	Understanding Computer Application and Control in Land-based Technology	Optional	10
Y/601/4273	331	Understanding Land-based Machinery Management	Optional	10
M/600/9709	332	Business Management in the Land-based Sector	Optional	10
M/601/0021	333	Undertake an Investigative Project in the Land-based Sector	Optional	10
T/601/4250	334	Applications of Science in Land-based Engineering	Optional	5
A/600/9812	335	Undertake Retail Merchandising for the Land-based Sector	Optional	10
J/600/9635	336	Undertaking Specialised Land-based Workshop Practices	Optional	10
L/601/5310	337	Refrigerant Handling	Optional	2
F/601/5305	338	Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment	Optional	3
L/601/5307	339	Recognise and Reduce Risks in the land-based Engineering Work Area	Optional	
D/600/3436	340	Land-based Engineering Operations – Perform Thermal Joining Processes	Optional	10
F/600/9701	341	Participate in Business Planning and Improvement in the Land-based Sector	Optional	10



Y/600/3435	207	Provide Customer Care within Land-based Engineering Operations	Optional	5
A/600/3427	208	Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes	Optional	10
Y/600/3404	220	Service and Repair Electrical Systems on Land-based Equipment	Optional	10
A/600/3430	223	Land-based Engineering Operations – Use Calculations	Optional	5

## 1.2 Opportunities for progression

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

- Level 4 and above centre-based qualifications in Land-based Technology e.g. Foundation Degree, Higher National Diploma
- Level 3 or 4 qualifications in Work-based Land-based Service Engineering
- Other related qualifications

## 1.3 Qualification support materials

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

<b>Description</b>	<b>How to access</b>
Assignment guide	<a href="http://www.cityandguilds.com">www.cityandguilds.com</a>
Marking guide	<a href="mailto:information@cityandguilds.com">information@cityandguilds.com</a>
Information Sheets	<a href="http://www.cityandguilds.com">www.cityandguilds.com</a>
Fast track approval forms/generic fast track approval form	<a href="http://www.cityandguilds.com">www.cityandguilds.com</a>

## 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 areas 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 3 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 3 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 Level 3 Extended Diploma qualification, learners must have access to a work setting/placement.

## **2.3 Age restrictions**

These qualifications have been approved and accredited for 16-18, 18+ and 19+ learners. However there are no age limits attached to learners undertaking the qualification unless there 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 candidate 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](http://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
301	Land-based Engineering Operations – Service and Repair Engines and Components	H/600/3437	10
302	Understanding and Servicing Mechanical Power Transmission Systems	M/601/4263	10
303	Understanding Health, Safety and Welfare in the Land-based Engineering Workplace	L/601/4271	10
304	Service and Repair Hydraulic Systems and Components on Land-based Equipment	H/600/3440	5
305	Understanding Land-based Vehicle Chassis Systems	M/601/4280	10
306	Undertake and Review Work Related Experience in the Land-based Industries	R/600/9394	10
307	Understanding and Working with Land-based Vehicle Engine Technology	J/601/4267	10
308	Inspect and Test Land-based Machinery and Equipment	A/600/3444	10
309	Undertaking Land-based Workshop Practice	M/600/9631	10
310	Maintain Electronic Control and Monitoring Systems on Land-based Equipment	M/600/3439	10
311	Service and Repair Suspension Systems on Land-based Equipment	K/600/3438	5
312	Service and Repair Pneumatic Systems and Components for Land-based Equipment	K/600/3441	5
313	Service and Repair Powershift Hydrostatic and CVT Transmissions on Land-based Equipment	M/600/3442	10
314	Monitor the Handover and Installation of Land-based Equipment	T/600/3443	5
315	Operate and Service Land-based Vehicle Transmission Systems	L/601/4254	10
316	Undertaking Land-based Machinery Operations	H/600/9805	10
317	Understand and Work with Land-based Repair Processes and Materials Technology	Y/601/4256	10
318	Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)	K/601/4259	10
319	Understanding and Servicing Land-based Harvesting Machinery (Processing)	D/601/4260	10
320	Working with Land-based Construction Plant Materials Handling Equipment	Y/601/4287	10
321	Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment	L/601/4285	10
322	Working with Land-based Diesel Fuel Injection Systems	D/601/4288	10
323	Undertaking Land-based Technology Engineering Drawing	J/601/4284	10
324	Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)	K/601/4262	10
325	Working with Land-based Machinery (Application	H/601/4289	10

	Equipment)		
326	Working with Land-based Tool Hire Machinery and Mechanisms	Y/601/4290	10
327	Understanding and Working with Groundcare Equipment	T/601/4264	10
328	Undertaking 4WD Vehicle Maintenance, Operation and Recovery	T/601/4281	10
329	Familiarisation and Management of Land-based Vehicles	F/601/4252	10
330	Understanding Computer Application and Control in Land-based Technology	J/601/4270	10
331	Understanding Land-based Machinery Management	Y/601/4273	10
332	Business Management in the Land-based Sector	M/600/9709	10
333	Undertake an Investigative Project in the Land-based Sector	M/601/0021	10
334	Applications of Science in Land-based Engineering	T/601/4250	5
335	Undertake Retail Merchandising for the Land-based Sector	A/600/9812	10
336	Undertaking Specialised Land-based Workshop Practices	J/600/9635	10
337	Refrigerant Handling	L/601/5310	2
338	Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment	F/601/5305	3
339	Recognise and Reduce Risks in the Land-based Engineering Work Area	L/601/5307	5
340	Land-based Engineering Operations – Perform Thermal Joining Processes	D/600/3436	10
341	Participate in Business Planning and Improvement in the Land-based Sector	F/600/9701	10
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
220	Service and Repair Electrical Systems on Land-based Equipment	Y/600/3404	10
223	Land-based Engineering Operations – Use Calculations	A/600/3430	5



## Certification/grading modules

City & Guilds unit number	Title
910	Certification module for Level 3 Certificate in Land-based Technology – pass grade
911	Certification module for Level 3 Certificate in Land-based Technology – merit grade
912	Certification module for Level 3 Certificate in Land-based Technology – distinction grade
913	Certification module for Level 3 Subsidiary Diploma in Land-based Technology – pass grade
914	Certification module for Level 3 Subsidiary Diploma in Land-based Technology – merit grade
915	Certification module for Level 3 Subsidiary Diploma in Land-based Technology – distinction grade
916	Certification module for Level 3 Diploma in Land-based Technology – pass grade
917	Certification module for Level 3 Diploma in Land-based Technology – merit grade
918	Certification module for Level 3 Diploma in Land-based Technology – distinction grade
919	Certification module for Level 3 Extended Diploma in Land-based Technology – pass grade
920	Certification module for Level 3 Extended Diploma in Land-based Technology – merit grade
921	Certification module for Level 3 Extended Diploma in Land-based Technology – distinction grade
925	Certification module for Level 3 Certificate in Land-based Technology – distinction* grade
926	Certification module for Level 3 Subsidiary Diploma in Land-based Technology – distinction * grade
927	Certification module for Level 3 Diploma in Land-based Technology – distinction* grade
928	Certification module for Level 3 Extended Diploma in Land-based Technology – distinction* grade
957	Certification module for Level 3 90-Credit Diploma in Land-based Technology – pass grade
958	Certification module for Level 3 90-Credit Diploma in Land-based Technology – merit grade
959	Certification module for Level 3 90-Credit Diploma in Land-based Technology – distinction grade
960	Certification module for Level 3 90-Credit Diploma in Land-based Technology – distinction* grade

## 6 Registration and Certification

The Level 3 Certificate, Subsidiary Diploma, 90-Credit Diploma, Diploma and Extended 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 0075-03 and that all 0075-03 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, Subsidiary Diploma, Diploma and Extended 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 3 Certificate in Land-based Technology at an overall merit grade, then the certification module 911 needs to be submitted. Please see the Rules of Combination below or the City & Guilds catalogue.

<b>Level 3 Certificate in Land-based Technology</b> <b>QAN 501/0693/4</b>	
Rules for achievement of qualification	30 credits from (301-305, 307-331, 208 Plus 910 from certification at pass grade

<b>Level 3 Certificate in Land-based Technology</b> <b>QAN 501/0693/4</b>	
Rules for achievement of qualification	30 credits from 301-305, 307-331, 208 Plus 911 from certification at merit grade

<b>Level 3 Certificate in Land-based Technology</b> <b>QAN 501/0693/4</b>	
Rules for achievement of qualification	30 credits from 301-305, 307-331, 208 Plus 912 from certification at distinction grade

<b>Level 3 Certificate in Land-based Technology</b> <b>QAN 501/0693/4</b>	
Rules for achievement of qualification	30 credits from 301-305, 307-331, 208 Plus 925 from certification at distinction* grade

<b>Level 3 Subsidiary Diploma in Land-based Technology</b> <b>QAN 501/0694/6</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 35 credits from 302, 305- 331, 339, 208 Plus 913 from certification at pass grade

<b>Level 3 Subsidiary Diploma in Land-based Technology</b> <b>QAN 501/0694/6</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 35 credits from 302, 305-331, 339, 208 Plus 914 from certification at merit grade

<b>Level 3 Subsidiary Diploma in Land-based Technology</b> <b>QAN 501/0694/6</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 35 credits from 302, 305-331, 339, 208 Plus 915 from certification at distinction grade

<b>Level 3 Subsidiary Diploma in Land-based Technology</b> <b>QAN 501/0694/6</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 35 credits from 302, 305-331, 339, 208 Plus 926 from certification at distinction* grade

<b>Level 3 90-Credit Diploma in Land-based Technology</b> <b>QAN 600/5945/X</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 65 credits from 302, 305-341, 207-208, 220 Plus 957 from certification at pass grade

<b>Level 3 90-Credit Diploma in Land-based Technology</b> <b>QAN 600/5945/X</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 65 credits from 302, 305-341, 207-208, 220 Plus 958 from certification at merit grade

<b>Level 3 90-Credit Diploma in Land-based Technology</b> <b>QAN 600/5945/X</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 65 credits from 302, 305-341, 207-208, 220 Plus 959 from certification at distinction grade

<b>Level 3 90-Credit Diploma in Land-based Technology</b> <b>QAN 600/5945/X</b>	
Rules for achievement of qualification	25 credits from 301, 303-304 Plus a minimum of 65 credits from 302, 305-341, 207-208, 220 Plus 960 from certification at distinction* grade

<b>Level 3 Diploma in Land-based Technology</b> <b>QAN 501/0681/8</b>	
Rules for achievement of qualification	35 credits from 301, 303-305 Plus a minimum of 85 credits from 302, 306-341, 207-208, 220 Plus 916 from certification at pass grade

<b>Level 3 Diploma in Land-based Technology</b> <b>QAN 501/0681/8</b>	
Rules for achievement of qualification	35 credits from 301, 303-305 Plus a minimum of 85 credits from 302, 306-341, 207-208, 220 Plus 917 from certification at merit grade

<b>Level 3 Diploma in Land-based Technology</b> <b>QAN 501/0681/8</b>	
Rules for achievement of qualification	35 credits from 301, 303-305 Plus a minimum of 85 credits from 302, 306-341, 207-208, 220 Plus 918 from certification at distinction grade

<b>Level 3 Diploma in Land-based Technology</b> <b>QAN 501/0681/8</b>	
Rules for achievement of qualification	35 credits from 301, 303-305 Plus a minimum of 85 credits from 302, 306-341, 207-208, 220 Plus 927 from certification at distinction* grade

<b>Level 3 Extended Diploma in Land-based Technology</b> <b>QAN 501/0682/X</b>	
Rules for achievement of qualification	75 credits from 301, 303-309 Plus a minimum of 105 credits from 302, 310-341, 207-208, 220, 223 Plus 919 from certification at pass grade

<b>Level 3 Extended Diploma in Land-based Technology</b> <b>QAN 501/0682/X</b>	
Rules for achievement of qualification	75 credits from 301, 303-309 Plus a minimum of 105 credits from 302, 310-341, 207-208, 220, 223 Plus 920 from certification at merit grade

<b>Level 3 Extended Diploma in land-based Technology</b> <b>QAN 501/0682/X</b>	
Rules for achievement of qualification	75 credits from 301, 303-309

<p>Plus a minimum of 105 credits from 302, 310-341, 207-208, 220, 223 Plus 921 from certification at distinction grade</p>
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<p><b>Level 3 Extended Diploma in land-based Technology QAN 501/0682/X</b></p>	
<p>Rules for achievement of qualification</p>	<p>75 credits from 301, 303-309 Plus a minimum of 105 credits from 302, 310-341, 207-208, 220, 223 Plus 928 from certification at distinction* grade</p>

- Learners must be registered at the beginning of their course. Centres should submit registrations using Walled Garden or Form S (Registration), under scheme/complex 0075-03.
- When assignments have been successfully completed results should be submitted on Walled Garden or Form S (Results submission). One of the certification/grading modules 910 to 921 or 925 to 928 or 957 to 960 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 Full 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 301

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

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding 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, understanding and skills required to perform service and repair procedures on engines within land based engineering.

### Learning outcomes

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

1. Perform service and repair procedures on engines and their components
2. Identify engine faults
3. Understand how to analyse and interpret findings from engine inspections and rectify
4. Understand how to take engine measurements

### 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 301**                      **Land-based Engineering Operations – Service and Repair Engines and Components**

**Outcome 1**                      Perform service and repair procedures on engines and their components

### **Assessment Criteria**

The learner can:

1. Prepare, **inspect** and record the **condition of engines** and their **components**
2. Use correct **measuring equipment** to verify compliance of **engine components**
3. Investigate failed or worn parts and record and **report findings**

### **Range**

#### **Engines**

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

### **Unit content**

#### **Inspect**

Visual, audible, measurement

#### **Condition of engine**

How the engine and its components visually appear during the inspection verified

#### **Measuring equipment**

Flat surface, Micrometer, dial gauge, compression gauge, Plastigage, feeler gauges, bore gauge

#### **Engine components**

Cylinder block components (engine block, crankshaft, connecting rods, pistons, piston rings), cylinder liners ( wet, dry), timing drives, flywheel, balancer units, cylinder head components (cylinder head, head gasket, valve guides, inlet and exhaust manifolds), valve train (camshaft, cam followers), pushrods, rocker shaft, rocker arms, valves, valve springs, valve rotators

#### **Report findings**

Select report format (table, pictorial report, written report, and diagram) to show the condition of the engine and its components, including reasons for any failure

# Unit 301 Land-based Engineering Operations – Service and Repair Engines and Components

## Outcome 2 Identify engine faults

### Assessment Criteria

The learner can:

1. Carry out **tests** to determine the cause of different **engine problems**
2. Set and adjust **engine performance** within **specified limits**
3. Identify and rectify engine system **faults**

### Range

#### Engines

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

### Unit content

#### Tests

Compression, engine power/torque, fuel consumption, fuel/oil pressure, visual, audible, Information and Communications Technologies (ICT), emissions, road test, methods used to analyse test data, use of testing equipment, for example dynamometer, compression cylinder leakage tester, fuel injection testing equipment, engine oil pressure and temperature gauges, coolant system leakage testers, exhaust gas analysis

#### Engine problems

Poor running, excessive fuel/oil consumption, low power, poor performance, misfire, backfire, incorrect engine oil pressure, incorrect engine temperature, seizure, abnormal noise, non starting, excessive engine breathing, engine system pressure abnormalities, excessive fuel use, incorrect timing, excessive emissions, incorrect fuel/air mixture, poor cold starting

#### Engine performance

Power, torque, Revs Per Minute (RPM), fuel use, emissions

#### Specified limits

Manufacturers' instructions, health and safety, current legislation, risk assessments

#### Faults

Faults relating to mechanical systems for example engine, transmission, steering, suspension, brakes, air conditioning, electrical systems for example starting, charging, lighting, auxiliary, instrumentation, electronic systems for example driver information, engine management, headland management, sensors, Engine Control Units (ECU), hydraulic systems for example pumps, valves, filters, linkages, clutch packs



## **Unit 301 Land-based Engineering Operations – Service and Repair Engines and Components**

**Outcome 3** Understand how to analyse and interpret findings from engine inspections and rectify

### **Assessment Criteria**

The learner can:

1. Describe how to identify and rectify the cause of **engine problems**
2. Explain the **methods of sealing combustion chambers, fuel and ignition systems**
3. Describe the **effects** of moisture and contaminants in fuel and ignition systems
4. Explain the procedure to verify correct engine timing covering both static and dynamic timing

### **Range**

#### **Engines**

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

### **Unit content**

#### **Engine problems**

Poor performance, misfire, backfire, incorrect engine oil pressure, incorrect engine temperature, seizure, abnormal noise, non starting, excessive engine breathing, engine system pressure abnormalities, excessive fuel use, incorrect timing, excessive emissions, incorrect fuel/air mixture, poor cold starting, restricted intake/exhaust flow

#### **Methods of sealing combustion chambers, fuel and ignition systems**

Head gasket, valves, valve stem seal, valve seats, piston rings, fuel pipes, sealed fuel tanks, breathers, sealed ignition systems

#### **Effects**

Non Starting, poor running, misfire, poor acceleration

## Unit 301

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

## Outcome 4

Understand how to take engine measurements

### Assessment Criteria

The learner can:

1. Describe the methods and techniques of taking engine specific **measurements**

### Range

#### Engines

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

### Unit content

#### Measurements

Piston ring gap, cylinder ovality, cylinder protrusion, cylinder liner/bore ovality and taper, crankshaft end float and journal ovality, piston/head clearance, valve and valve operating system clearance, cylinder head flatness, ancillary component within specification

# **Unit 301                    Land-based Engineering Operations – Service and Repair Engines and Components**

## **Notes for guidance**

This unit is designed to provide learners with knowledge and understanding of how to service and repair engines and related components of land-based power units and equipment to be found in their area of study, identify common engine faults, analyse and interpret findings from engine inspections, including measuring engines and related components. 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, 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.

In Outcome 1, delivery is likely to include a large practical content, which may include demonstrations and supervised practical workshop sessions. The learner will gain practical skills in inspecting the condition of engines, recording the results, and comparing the recorded results with the correct specifications. It is important that delivery also covers the identification and use appropriate tools to measure these engine components, as well as investigating failed/worn components.

In Outcome 2, delivery is also likely to be highly practical in nature. Learners will need sufficient supervised practical workshop sessions to enable them to identify common engine faults. This will involve testing, adjusting and rectifying engine faults. Part of this will require working on running machinery, so emphasis should be directed to safe working practices. It is important that all work is completed in line with manufacturers' specifications.

Delivery of Outcomes 3 and 4 provides the underpinning knowledge and understanding for the practical activity in Outcomes 1 and 2, so it is important that close links are made.

In Outcome 3, the learner will gain an understanding of how to identify and rectify the causes of common engine faults. It would be beneficial for delivery to include use of case study material, providing learners with a range of diagnostic test results and enabling them to develop the skills to recognise the potential engine problems. Learners will also gain an understanding of the methods of sealing combustion chambers, fuel and ignition systems, the effects of moisture and contaminants in fuel and ignition systems and the procedure to verify correct engine timing. Delivery is likely to be predominantly through classroom based activities, supported by practical demonstrations and linked to Outcomes 1 and 2.

In Outcome 4 the learner will learn the correct method and technique for taking specified measurements on an engine, including the importance of correct and accurate measurement, using the correct apparatus for measurement, and ensuring the measurement is taken to the correct accuracy. Delivery is likely to include classroom based activity together with practice of taking correct measurements using a range of testing equipment.

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## Books

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Manufacturers publications and manuals

## Journals

Farmers Guardian  
Profi International  
Farmers Weekly

## Websites

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

## Unit 302

# Understanding and Servicing Mechanical Power Transmission Systems

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to mechanisms and methods of transmitting mechanical power in land based vehicle and machine drivelines and how knowledge of this can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

The aim of this unit is for learners to familiarise themselves with mechanisms and methods of transmitting mechanical power in land based vehicle and machine drivelines.

### Learning outcomes

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

1. Know the types of components used to transmit mechanical drives
2. Understand drive system limitations and use
3. Service and maintain mechanical drive systems
4. Overhaul and repair mechanical drive systems that have failed

### 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 National Occupational Standards for Land-based service engineering.

### 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 302                      Understanding and Servicing Mechanical Power Transmission Systems**

**Outcome 1                      Know the types of components used to transmit mechanical drives**

### **Assessment Criteria**

The learner can:

1. Describe the **function** of a given range of **mechanical transmission components**
2. Identify any **faults or wear areas** on a range of mechanical transmission components
3. Select from the range of components, items that would make up a **complete mechanical drive system** and describe how the system operates
4. From a selected range of mechanical transmission systems, state the possible **factors** resulting in the manufacturer's choosing that system.

### **Unit content**

#### **Function**

How it transmits power

#### **Mechanical transmission components**

Shafts, Universal Joint, constant velocity joint, gears, belts, chains, springs, overrun device, slip clutch, shear bolts, keys and keyways. Compression/tension springs, bearings, bushes and friction drive components.

#### **Faults or wear areas**

Misalignment, bearing failure, stretched components from heat/overload, worn components from lack of lubrication, worn components from excessive friction. Broken components from overload/shock loadings. Breakages/wear due to lack of maintenance

#### **Complete mechanical drive system**

Gearbox, transfer box, belt and pulley systems, chain and gear systems, shaft and UJ/CV joints

#### **Factors**

Cost, power and torque transmitted, driveline protection required, operating conditions, components available to manufacturer, components used in same or other machines in manufactures range.

## Unit 302

# Understanding and Servicing Mechanical Power Transmission Systems

## Outcome 2

Understand drive system limitations and use

### Assessment Criteria

The learner can:

1. Explain the **limitations** of different **types of mechanical drive systems**
2. Compare **reasons** as to where different systems are suited and unsuitable

### Unit content

#### Limitations

Power, torque and speed, capacity, longevity, serviceability, size of transmission unit

#### Types of mechanical drive systems

Shafts, Universal Joint, constant velocity joint, gears, belts, chains, springs, overrun device, slip clutch, shear bolts, keys and keyways. Compression/tension springs, bearings, bushes and friction drive components

#### Reasons

Power, torque and speed, capacity, longevity, serviceability, size of transmission unit, cost of unit, cost of servicing/repair, Input source, operating conditions

## Unit 302

# Understanding and Servicing Mechanical Power Transmission Systems

## Outcome 3

Service and maintain mechanical drive systems

### Assessment Criteria

The learner can:

1. Carry out an **assessment** of possible **risks** prior to performing service and maintenance tasks to the **mechanical drive systems** on **land-based vehicles and machines**
2. Following manufacturers guidelines, carry out **periodic maintenance and adjustments** on mechanical transmission systems
3. Produce **service tasks** to suit the transmissions maintained detailing all **critical adjustments and measurement data**
4. **Report** on possible implications due to incorrect maintenance and adjustments to each system.

### Unit content

#### Assessment

Visual, audible, written risk assessment

#### Risks

Slips, trips, falls, heavy loads, falling objects, oils and fluids, heat, high pressure fluids

#### Mechanical drive systems

Gearbox, transfer box, belt and pulley systems, chain and gear systems, shaft and UJ/CV joints

#### Land-based vehicles and machines

Hand held, pedestrian, self propelled, mounted, trailed machines

#### Service tasks

Written procedures covering routine maintenance, strip down and/or rebuild

#### Critical adjustments and measurement data

Backlash, alignment, clearance, spacing/shimming, bearing preload, tightening torque, locking of fasteners, gear contact pattern, spacing, tension/compression spring length

#### Report

Verbal, written or visual



## Unit 302

# Understanding and Servicing Mechanical Power Transmission Systems

### Outcome 4

Overhaul and repair mechanical drive systems that have failed

#### Assessment Criteria

The learner can:

1. Produce a **plan of work** to outline the procedure to be adopted for the removal of a **mechanical transmission unit** from a **land-based vehicle** or machine in preparation for **overhaul or repair**
2. Produce a **risk assessment** prior to performing practical removal, overhaul or repair procedures to a transmission unit
3. Carry out a removal, overhaul and repair task on a mechanical land-based transmission unit and check the **integrity of the unit** on completion
4. **Report** on the overhaul and repair process, specialised tools, equipment and materials used

#### Unit content

##### Plan of work

Order of dismantling and refitting of unit. Draining, storage, disposal and refilling of fluids

Risk assessment

Tools required, Personal Protective Equipment (PPE)

##### Mechanical transmission unit

Gearbox, transfer box, belt and pulley systems, chain and gear systems, shaft and UJ/CV joints

##### Land-based vehicle

Hand held, pedestrian, self propelled, mounted, trailed machines

##### Overhaul or repair

Daily, weekly monthly and annual service, wearing part replacement, breakdown repair

##### Risk assessment

Careful examination of what could cause harm to people, so that it can be weighed up whether enough precautions have been taken or should more be done to prevent harm. Record in a manner so others can see the risks involved easily

##### Integrity of the unit

Fitness of unit for the purpose it was designed for

##### Report

Concise report, easy to see, such as a comparison table

## Unit 302

# Understanding and Servicing Mechanical Power Transmission Systems

### Notes for guidance

This unit covers the basic transmission components and how they are connected to make up mechanical drive systems. Covers the servicing and repair, removal, replacement and setting up of these components. It also allows the learner to understand why manufacturers choose certain components to make up complete transmission systems.

Centres and tutors need to be aware of the need to safeguard learners, when delivering and assessing units where the operation and servicing of machinery is involved. This unit requires the learner to undertake machinery servicing 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.

Outcome 1 looks at the function of the components, where they are liable to wear, or break. The second part looks at how components are combined to make transmission units, and why choose certain units to land based machinery. This unit will require classroom based delivery however the learner will benefit from practically based activities in order to develop knowledge of a range of components and machinery.

Outcome 2 will require the learner to understand the limitations of different components, and why different components are suited for different tasks. Outcome 1 and Outcome 2 could be taught in conjunction with each other as Outcome 2 can develop the knowledge learnt in Outcome 1. Delivery of this Outcome will largely involve classroom based delivery however the learner should have access to a range of components to help develop knowledge and understanding.

Outcome 3 requires the learner to assess service, adjust and produce service tasks on power transmission systems. The learner will also be expected to understand the possible problems that may be caused by incorrect maintenance and adjustments. Outcome 3 will involve a mixture of classroom based and practically based delivery.

Outcome 4 allows the learner to expand on Outcome 3, by planning and carrying out removal overhaul and repair of components, including producing a risk assessment. The learner will also be required to produce a report on the task that they have completed. This Outcome requires the learner to assess the full process of land based machinery mechanics by producing assessments and reports as well as carrying out practical based work. This Outcome is mainly practically based, but some classroom activity will be required for the learner to produce assessments and reports.

## References

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- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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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<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 303

# Understanding Health, Safety and Welfare in the Land-based Engineering Workplace

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to safe working skills and understanding and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the foundations of health and safety in the workplace
2. Understand the organisational requirements within the workplace
3. Be able to assess safe working environment, policies and procedures in the workplace
4. Understand how to minimise hazards and risks in the workplace

### 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 Land-based service engineering NOS.

### 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 303                      Understanding Health, Safety and Welfare in the Land-based Engineering Workplace**

**Outcome 1                      Understand the foundations of health and safety in the workplace**

### **Assessment Criteria**

The learner can:

1. Explain legal health and safety **responsibilities** of an **employer** and **employee**
2. Explain how **legislation** affects the safe working practices and procedures for employee and employer in the workplace
3. Examine implications to the **individual, business** and **national economy** of accidents in the workplace

### **Unit content**

#### **Employer's responsibilities**

Health, safety and welfare, safe systems of work, risk assessments, instruction, training and supervision, competent employees, written health and safety policy

#### **Employee's responsibilities**

Responsibility for themselves, responsibility for others, co-operation, communication, reporting defects, no interfering with health and safety equipment

#### **Legislation**

Health and Safety at Work etc Act 1974, Control of Substances Hazardous to Health Regulations (2002) (COSHH), Reporting Injuries, Diseases and Dangerous Occurrence Regulations (RIDDOR), Provision and Use of Work Equipment Regulations (PUWER), Lifting Operations and Lifting Equipment Regulations (LOLER), Noise at Work regulations 1989, Workplace health, safety and Welfare (Health, Safety and Welfare) Regulations 1992, Grinding wheel regulations

#### **Individual**

Pain, suffering and grief, loss of wages, family, social life, loss of ability to work, long-term disability/illness

#### **Business**

Loss of business, damage to reputation, loss of income, sickness payments, insurance cost, prosecution/civil costs, damage to machinery, machinery out of action

#### **National economy**

Stricter control procedures/guidelines, higher insurance costs

## **Unit 303                      Understanding Health, Safety and Welfare in the Land-based Engineering Workplace**

**Outcome 2                      Understand the organisational requirements within the workplace**

### **Assessment Criteria**

The learner can:

1. Explain the framework of **health and safety management** within a selected land-based engineering business
2. Explain how a selected land based engineering business **promotes** and **implements health and safety policies and practices**

### **Unit content**

#### **Health and safety management**

Chain of responsibility (employee, supervisor, managing director), employee responsibility, employer's responsibility, risk assessments, safety audits

#### **Promotes**

Posters, leaflets, monthly accident figures

#### **Implements**

Training, tool box talks, risk assessments, safety audits, monitoring

#### **Health and safety policies and practices**

Company's Health and Safety Statement, training, accident reporting, hazard reduction, major incident procedure, use of flammable liquids and gases, employees responsibilities, COSHH, manual handling

## Unit 303

# Understanding Health, Safety and Welfare in the Land-based Engineering Workplace

## Outcome 3

Be able to assess safe working environment, policies and procedures in the workplace

### Assessment Criteria

The learner can:

1. Identify potential **hazards** and **risks** to the health in a selected land-based engineering situation
2. **Assess risks** for given land-based engineering operations
3. Report on the **procedures** for reporting injuries, diseases and dangerous occurrences within a selected land-based engineering business

### Unit content

#### Potential hazards and risks

Fatal, non-fatal accidents: occupational asthma, dermatitis, zoonoses, noise, muscular skeletal disorders, slips, trips and falls, contact with machinery, struck by moving object, contact with electricity, machinery collapsing /overturning, use of flammable liquids and gases

#### Assess risks

Specific to task, hazards, who's at risk, control measures, legal requirements, review, monitor

#### Procedures

COSHH, Hierarchy of risk control, Report Injuries, RIDDOR, use of accident book, mishap forms, near-miss reports

## Unit 303

# Understanding Health, Safety and Welfare in the Land-based Engineering Workplace

### Outcome 4

Understand how to minimise hazards and risks in the workplace

#### Assessment Criteria

The learner can:

1. Justify **PPE** and **safety equipment** to be used when undertaking selected land based engineering operations
2. Explain how selected **regulations** affect the working practices in the workplace

#### Unit content

##### PPE

Gloves (latex, welding, rigger), goggles, steel toe capped boots, coveralls, dust mask, ear defenders, helmet, welding mask

##### Safety Equipment

Machine guards, welding curtains, gas regulators, emergency stop buttons, gas extraction units, first aid kit, fire extinguisher, axel stands, wheel chocks, power transformers

##### Regulations

Health and Safety at Work etc Act 1974, COSHH, RIDDOR, PUWER, LOLER, Noise at Work regulations 1989, Workplace health, safety and Welfare (Health, Safety and Welfare) Regulations 1992



## **Unit 303                      Understanding Health, Safety and Welfare in the Land-based Engineering Workplace**

### **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.

Outcome 1 enables the learner to demonstrate and awareness of health and safety responsibilities within the work place, both as an employee and an employer. An understanding of legislation and how it affects working practices and procedures must also be shown. The learner will also be able to show how their own actions which cause accidents within the workplace can affect the individual, the business and the national economy.

Outcome 2 enables the learner to explain the framework of health and safety management with in their workplace, and explain how the health and safety policies content and purpose affect their daily working. The learner will also be able to explain how companies promote and implement health and safety in the work place through policies and practices

Outcome 3 will enable the learner to identify potential hazards and risks in the workplace and show how these risks can be minimised and controlled through risk assessment. The learner will also be able to explain the procedure for reporting injuries, diseases and dangerous occurrences within the land-based engineering sector.

Outcome 4 enables learners to explain how to minimise hazards and risks in the workplace through the use of PPE and safety equipment. Learners will also be able to explain how health and safety regulations affect their working practices, and be able to analyse how health and safety procedures and systems within the engineering workshop are adopted and used.

## References

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Control of substances hazardous to health. The control of substances hazardous to health regulations 2002. Approved code of practice and guidance (fourth edition) 2002. HSE Books. ISBN 0717625346

### Journals

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Farmers Weekly

Farm Ideas

### Websites

[www.hse.gov.uk](http://www.hse.gov.uk)

Health and Safety Executive

## Unit 304

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

**Level:** 3

**Credit value:** 5

### Unit aim

This unit aims to provide learners with an understanding of servicing and maintenance on 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 repair and service hydraulic systems 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. Understand 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 **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 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 304

# 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. **Inspect performance** of hydraulic systems and components
2. Prepare the system to be tested and carry out tests using diagnostic tools to assess system performance
3. **Interpret diagnostic results** and recommend action
4. Remove, dismantle, repair and reinstate system and components to manufacturer's specifications

#### Range

#### Skills

Testing, diagnosis, evaluation, interpretation and reporting

#### Circuit types

Open centre, closed centre, load sensed, hydrostatic

#### Components

Hydraulic pumps and motors (fixed and variable displacement) pressure maintaining, relief, shock valves, hydraulic control valves, distributors, solenoid valves, proportional valves, pressure differential valves, pilot operated valves, trailer brake valves, hydraulic rams, single, double acting and cushioned, directional flow valves, flow dividers, orbital and priority valves, restrictors, reservoirs, accumulators

#### Unit content

##### Inspect performance

Methods of inspecting, testing and evaluating the performance of hydraulic systems and their components

##### Interpret diagnostic results

Record, interpret and evaluate diagnostic results and make recommendations for the actions to be taken

## **Unit 304            Service and Repair Hydraulic Systems and Components on Land-based Equipment**

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

### **Assessment Criteria**

The learner can:

1. **Interpret circuit diagrams** and symbols and their functions within the system
2. Explain how to dismantle, repair and reinstate hydraulic components and systems
3. Explain the application of **valves** and the **function of hydraulic systems** and components
4. Identify **diagnostic tests** that will evaluate hydraulic system performance
5. **Interpret** and compare **test results**

### **Range**

#### **Skills**

Testing, diagnosis, evaluation, interpretation and reporting

#### **Circuit types**

Open centre, closed centre, load sensed, hydrostatic circuits

#### **Components**

Hydraulic pumps and motors (fixed and variable displacement) pressure maintaining, relief, shock valves, hydraulic control valves, distributors, solenoid valves, proportional valves, pressure differential valves, pilot operated valves, trailer brake valves, hydraulic rams, single, double acting and cushioned, directional flow valves, flow dividers, orbital and priority valves, restrictors, reservoirs, accumulators

#### **Unit content**

##### **Interpret circuit diagrams**

The function and relationship of their components to one another and the international symbols used.

##### **Valves**

Orbitrol valves, proportional valves, load sensed circuits, hydrostatic circuits, and trailer brake valves

##### **Function of hydraulic systems**

The application of systems, the valves/components used within them, their functions and influences on hydraulic performance

Hydraulic systems and components: hydraulic pumps and motors fixed and variable displacement, hydraulic pressure maintaining valves, relief valves, shock valves, hydraulic control valves, distributors, solenoid valves, proportional valves, pressure differential valves, pilot operated valves, trailer brake valve, hydraulic rams, single, acting, double acting and cushioned, hydraulic direction flow valves, flow dividers, orbital valves, priority valves, restrictors, reservoirs, accumulators

##### **Diagnostic tests**

Flow rate, temperature, pressure

**Interpret test results**

Interpret and compare diagnostic test results with manufacturer's specifications, evaluate and summarise repair options and recommendations

## Unit 304

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

### Notes for guidance

This unit is designed to provide the learners with the knowledge, skills and understanding of how to maintain/diagnose/reinstate hydraulic systems and their components used in land-based equipment.

This is an important unit as the complexity of hydraulic systems and their applications utilised within land-based equipment continues to develop. Every opportunity must be taken to expose the learner to a wide range of systems to enhance their confidence in this area. Particular attention needs to be given to the range within this unit.

At all times the use of safe working practices and compliance with current legislation must be reinforced. Centres and tutors need to be aware of the need to safeguard 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 and current legislation must be strictly enforced and repeated throughout

Emphasis should be placed on the evaluation and verification of hydraulic system performance and the methods used to compile recommendations of repair options

For Outcome 1 learners need to gain practical skills in inspecting and testing hydraulic systems and components, interpreting the results and carrying out servicing and repair. It is likely that delivery will be predominantly practical in nature, including demonstrations, supervised workshop practice and links to appropriate work placements.

For Outcome 2 learners need to gain an understanding of the way in which hydraulic systems work, the function of their components and the diagnostic testing that can evaluate performance. It is important that learners understand the aspects of performance that can be measured, and the appropriate diagnostic tools and equipment. Delivery is likely to include a mix of classroom based sessions and practical activities, which may be closely linked to those in Outcome 1. It will be useful to have a range of test results available that learners can interpret and compare.

## References

### Books

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Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X  
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<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers



**Level:** 3

**Credit value:** 10

### **Unit aim**

This unit aims to provide learners with an understanding of the function, operation and maintenance requirement of land-based steering and braking systems and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

The aim of this unit is for learners to familiarise themselves with steering, braking and suspension systems. Once familiar with the systems the learners will be able to carry out maintenance, adjustments and repairs to ensure the efficiency of land based vehicles.

### **Learning outcomes**

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

1. Understand the function, operation and maintenance requirements of land-based vehicle steering systems
2. Understand the function, operation and maintenance requirements of land-based vehicle braking systems
3. Understand the function, operation and maintenance requirements of land-based vehicle suspension systems
4. Be able to carry out serviceability tests and repairs to land-based vehicle steering, braking and suspension systems

### **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 Land-based service engineering NOS.

### **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 305

### Outcome 1

## Understanding Land-based Vehicle Chassis Systems

Understand the function, operation and maintenance requirements of land-based vehicle steering systems

### Assessment Criteria

The learner can:

1. Explain the function and operation of land-based vehicle steering systems
2. Examine land-based vehicle steering systems and **assess their need for** maintenance or repair
3. Carry out routine maintenance tasks to steering systems in accordance with **manufacturers requirements**

### Range

#### Steering systems

Manual, power assisted, hydrostatic, front, rear, 2/4 wheels steer, centre pivot, skid steer, crab steering, zero turn

### Unit content

#### Assess their need for maintenance or repair

Routine maintenance, planned wearing component replacement, emergency on site repair

Assessment delivered by report (verbal or written)

#### Manufacturer's requirements

Manufacturers' workshop manuals, operators books, service schedule, legislation

## Unit 305

### Outcome 2

## Understanding Land-based Vehicle Chassis Systems

Understand the function, operation and maintenance requirements of land-based vehicle braking systems

### Assessment Criteria

The learner can:

1. Explain the function and operation of land-based vehicle braking systems
2. Examine land-based vehicle braking systems and **assess their need for maintenance or repair**
3. Carry out **routine maintenance tasks** to braking systems in accordance with **manufacturers requirements**

### Range

#### Land-based vehicle braking systems

Disc, drum, band brakes, hydraulic, manual, electrical, pneumatic, hydro pneumatic operation, single, split, load compensating brake systems

### Unit content

#### Assess their need for maintenance or repair

Routine maintenance, planned wearing component replacement, emergency on site repair

Assessment delivered by report (verbal or written)

#### Manufacturers' requirements

Manufacturers' workshop manuals, operators books, service schedule, legislation

## Unit 305

### Outcome 3

## Understanding Land-based Vehicle Chassis Systems

Understand the function, operation and maintenance requirements of land-based vehicle suspension systems

### Assessment Criteria

The learner can:

1. Explain the function and operation of land-based vehicle suspension systems
2. Examine land-based vehicle suspension systems and **assess their need for maintenance and repair**
3. Carry out routine maintenance tasks to suspension systems in accordance with **manufacturers requirements**

### Range

#### Land-based vehicle suspension systems

Polymer, coil/leaf springs, hydraulic, pneumatic, torsion bar suspension, beam Axle, front/rear/independent suspension

### Unit content

#### Assess their need for maintenance and repair

Routine maintenance, planned wearing component replacement, emergency on site repair  
Assessment delivered by report (verbal or written)

#### Manufacturers' requirements

Manufacturers' workshop manuals, operators books, service schedule, legislation

## Unit 305

### Outcome 4

## Understanding Land-based Vehicle Chassis Systems

Be able to carry out serviceability tests and repairs to land-based vehicle steering, braking and suspension systems

### Assessment Criteria

The learner can:

1. Outline the procedure to be adopted for the removal of **chassis system units** from a land based vehicle in preparation for overhaul or repair
2. **Assess risks** prior to performing practical removal, overhaul or repair procedures to chassis system units
3. Carry out a **removal, overhaul and repair** task on land-based vehicle chassis system units and check the integrity of the unit on completion.

### Unit content

#### Chassis system units

Brakes, suspension, steering units

#### Assess risks

Assessing and recording risks prior to work, to highlight risks of injury/damage to learner, tutor, third parties, and machinery, actions required to minimise risks

#### Removal, overhaul and repair

Correctly and to manufacturers' specifications remove relevant chassis units, check, overhauled, repair, correctly replace, repairs

# Unit 305                      Understanding Land-based Vehicle Chassis Systems

## Notes for guidance

This unit is designed to provide learners with knowledge and understanding of the function, operation and maintain chassis systems (brakes steering and suspension) on land-based power units and equipment to be found in their area of study. It also allows learners the opportunity to carry out routine maintenance tasks to manufacturers' recommendations and specifications. At all times when practical tasks are carried out or assessed, an emphasis must be put on safe working practises and current legislation.

Centres and tutors need to be aware of the need to safeguard 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.

In Outcome 1 the learner will be given knowledge on the function and operation of land based steering system, as well as assessing need for maintenance and repair of these systems, according to manufacturers' stipulations. The Outcome requires the learner to compare a range of steering systems, to evaluate alternative designs and systems. It will be necessary to access to a range of modern equipment for these comparisons and evaluations to be made. Delivery is likely to include supervised practical activities, classroom based sessions and visits to other workshops to see alternative steering systems.

In Outcome 2, the learner gains knowledge of the function and operation of land based braking system, as well as assessing need for maintenance and repair of these systems, according to manufacturers' stipulations. The Outcome requires the learner to compare a range of braking systems, to evaluate alternative designs and systems. It will be necessary to access to a range of modern equipment for these comparisons and evaluations to be made. Delivery is likely to include a mix of practical and theory sessions, with learners given sufficient practical time to gain the necessary skills in routine maintenance.

In Outcome 3, the learner gains knowledge of the function and operation of land based suspension system, as well as assessing need for maintenance and repair of these systems, according to manufacturers' stipulations. The Outcome requires the learner to compare a range of suspension systems, to evaluate alternative designs and systems. It will be necessary to access to a range of modern equipment for these comparisons and evaluations to be made. Delivery is likely to include supervised practical activities, links to work placement and classroom based sessions.

In Outcome 4 the learner is expected to produce a step by step plan on how to remove chassis units from land-based vehicles. Part of this plan will require an understanding of health and safety procedures in the workshop and to carry out a risk assessment. As part of this the learner will carry out an inspection of the work premises and equipment to highlight hazards, risks and discrepancies which may impair safe working practices. The learner will then need to gain the skills to carry out a removal and repair/overhaul on the chassis units, requiring knowledge of possible wearing parts, and how to measure/judge the wear of these components. From these observations and measurements, a report will be produced, reporting what was done, tools used, how it was done, and the findings. Delivery is likely to be a mix of supervised workshop sessions and classroom based delivery of the underpinning theory.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers' publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 306

# Undertake and Review Work Related Experience in the Land-based Industries

**Level:** 3

**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 the environmental and land-based sector. 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. Understand the opportunities in the environmental and land-based industries
2. Be able to prepare for a work-based experience in the environmental and land-based industry
3. Be able to undertake a work-based experience in the environmental and land-based industry
4. Be able to review a work-based experience in the environmental and land-based sector

### 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 306                      Undertake and Review Work Related Experience in the Land-based Industries**

**Outcome 1                      Understand the opportunities in the environmental and land-based industries**

### **Assessment Criteria**

The learner can:

1. Evaluate **career and progression opportunities** within an environmental and land-based industry

### **Unit content**

#### **Career and progression opportunities**

Job roles relevant to the sector: managerial, supervisory, team worker, trainee, volunteer, common job titles within the relevant sector, main duties and responsibilities

Skills needed to fulfil duties and responsibilities of appropriate jobs: job specific, vocational and personal

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

## Unit 306

# Undertake and Review Work Related Experience in the Land-based Industries

## Outcome 2

Be able to prepare for a work-based experience in the environmental and land-based industry

### Assessment Criteria

The learner can:

1. **Select** an appropriate work-based experience and complete the **application process**
2. Demonstrate **interview skills** as an interviewee
3. Prepare for a work-based experience, identifying **targets, aims and objectives**

### Unit content

#### Select

Suitable work experience position based on existing skills, experience, qualifications, development of skills and experience to achieve future employment goals

#### Application process

Finding suitable job opportunities from e.g. trade magazines, websites, employer approaches to the centre, completion of an application form, curriculum vitae and letter of application

#### Interview skills

Interview preparation: Research the business and job role, suitable dress and personal presentation, information to find out and suitable questions to ask. Interview performance: attend punctually and dressed appropriately, answering questions, completion of other tests (e.g. practical, aptitude), and reflection on interview performance

#### Targets, aims and objectives

Aims: overall impact of work experience on skills, experience, future employability, targets / objectives, specific development of workplace skills and knowledge (e.g. technical, vocational, business, team working, communication and employability)

## Unit 306

## Undertake and Review Work Related Experience in the Land-based Industries

### Outcome 3

Be able to undertake a work-based experience in the environmental and land-based industry

#### Assessment Criteria

The learner can:

1. **Undertake** a selected appropriate work-based experience
2. Maintain a **record of activities and achievements** during a work-based experience.

#### Unit content

##### Undertake

Completion of 300 hours of appropriate work experience, attend punctually and reliably, work competently and in line with job role requirements, health and safety, security, confidentiality, effective working relationships with colleagues, supervisors and customers.

##### Record of activities and achievements

Job description for work role, main duties and responsibilities, regular daily working routine, diary of additional tasks, duties, learning experiences portfolio of work experience (e.g. photographs, witness statements, work experience provider's or assessor's reports, progress reviews)

## Unit 306

## Undertake and Review Work Experience in the Land-based Industries

### Outcome 4

Be able to review a work- based experience in the environmental and land-based sector

#### Assessment Criteria

The learner can:

1. **Present evidence** of activities and achievements during a work-based experience
2. **Review** a work-based experience, identifying strengths and areas for improvement

#### Unit content

##### Present evidence

Name of work experience provider, nature of the organisation (type of business, products or services, customers), organisation structure chart, job description for work role, main duties and responsibilities, regular daily working routine, health, safety and welfare of employees, customers, animals, diary of additional tasks, duties, learning experiences, portfolio of work experience (e.g. photographs, witness statements, work experience provider's or assessor's reports and progress reviews)

##### Review

Business effectiveness: products and services, physical resources (e.g. buildings, machinery, equipment), business procedures, staff management and supervision, employees' skills and development, marketing and customer relations, personal workplace effectiveness: work speed, work quality, punctuality, attendance, reliability, dress and personal presentation, working relationships with peers, working relationships with supervisor, work experience aims, objectives and targets, impact of work experience on future career ambitions

## Unit 306

# Undertake and Review Work Experience in the Land-based Industries

## Notes for guidance

Learners on vocational courses should have experience of the type of work that they hope to do, and of the expectations of potential future employers. Many Level 3 learners are likely to have already had experience of working in the land-based and environmental industries, so this unit seeks to provide new experience opportunities for these learners.

Ideally this unit should be undertaken in a real business environment relevant to the subject interest of the learner, but actual 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, as previous relevant and current work experience in the industry or as a member of a group of learners invited to carry out practical work on a suitable business.

Throughout the unit, the emphasis should be on safe working. It is expected that learners will be aware of safe working practices and familiar with accepted practices and behaviours within the context in which they are working.

Learners should complete the equivalent of 8 weeks (or 300 hours) work experience to achieve this unit. If work experience is in the industry, centres should be mindful of their responsibilities for ensuring that work placements have appropriate supervision, insurance and health and safety policies in place.

In Outcome 1, learners will explore the different job roles and responsibilities, and the job titles commonly associated with them in their specialist sector. This background understanding is likely to require some formal classroom teaching, and may be closely linked to material in the unit "Business Management". Learners should be encouraged to explore the range of employment opportunities and career paths within their specialist sector. It would be appropriate for employers to be invited to outline to learners their expectations in the workplace. Learners will then consider the skills and qualifications that are required for appropriate jobs for themselves and should be encouraged to think about skills and qualifications that they may need to acquire to achieve their employment and careers ambitions. Evaluation of career and progression opportunities should include advantages and disadvantages of at least 3 possible career pathways within their specialist sector. This should help them to identify suitable work experience.

Outcome 2 involves learners going through the process of applying for work experience. They will need to locate suitable job adverts or work experience opportunities, 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 for 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 for an interview they should reflect on their performance and how they could improve their effectiveness. Before commencing work experience they should set overall aims to be achieved during the period and SMART (specific, measurable, achievable, realistic, timescaled) targets or objectives for learning and improvement in relation to future career aims.

Outcome 3 requires that learners effectively complete their period of work experience, meeting the requirements of the workplace appropriate for their position. It would be advisable for their progress to be reviewed at least once during the period and they should have access to tutor support in case of difficulties arising. During their work placement learners must produce the details of their job role and working routine, maintain a diary at least weekly and collate other relevant information on their work placement, performance and achievements. It would be appropriate for tutors to complete a report in consultation with the work experience provider mid-way and at the end of the placement.

In Outcome 4, learners will use evidence from outcome 3 to present a report, oral and/or written, on their work experience business, job role, learning and achievements. They will then review the effectiveness of the workplace, making realistic and justified suggestions for improvement. Review of their own workplace performance and achievements should include all of the content identified, with reference to relevant evidence, e.g. reports, progress reviews, and the extent to which their aims, objectives/targets have been achieved. Learners should consider further training and experience that will help them to achieve their career ambitions.

## Unit 307

# Understanding and Working with Land-based Vehicle Engine Technology

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in vehicle engine technology and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education

### Learning outcomes

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

1. Understand the construction and operation of commonly used land-based vehicle compression ignition and spark ignition engines
2. Understand the construction and operation of associated land-based vehicle engine ancillary systems
3. Be able to test and diagnose faults in land-based vehicle engines and their ancillary systems
4. Be able to maintain and repair land-based vehicle engines and their ancillary systems

### 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 Land-based service engineering NOS.

### 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 307

# Understanding and Working with Land-based Vehicle Engine Technology

### Outcome 1

Understand the construction and operation of commonly used land-based vehicle compression ignition and spark ignition engines

#### Assessment Criteria

The learner can:

1. Explain the **construction** and **operation** of a **compression** ignition engine
2. Explain the construction and operation of a **spark ignition** engine; both two and four stroke

#### Unit content

##### Construction

Cylinder numbers, engine configuration Inline, vee, materials used cast steel, aluminium

##### Operation

Four stroke cycle, two stroke cycle

##### Compression

Ignition, diesel engines

##### Spark Ignition

Magneto, coil, solid state



## **Unit 307                      Understanding and Working with Land-based Vehicle Engine Technology**

**Outcome 2                      Understand the construction and operation of associated land-based vehicle engine ancillary systems**

### **Assessment Criteria**

The learner can:

1. Explain the construction and **operation** of the **lubrication** system
2. Explain the construction and operation of the cooling system; both **air and liquid**
3. Explain the construction and operation of the **fuel system**; both **diesel** and **petrol**
4. Explain the construction and operation of the **electrical system**

### **Unit content**

#### **Lubrication**

Oil- pump filters, strainers, oil ways, oil galleries

#### **Liquid**

Thermostat, bypass, radiator, water jacket, impeller, fan, fan drive, belt, electric motor, thermo coupled

#### **Air**

Cooling fins, jackets and shrouds, fans

#### **Fuel system diesel**

tank, lift pump, filters, fuel pump, injection pump, common rail, fuel injectors, electronic injectors, unit injectors, metering devices, sensors, electronic control unit, mechanical control (governors), fuel return, cold start devices

#### **Petrol fuel system**

tank, fuel pump, fuel filter, carburettor, float chamber, single diaphragm, double diaphragm fuel injection, sensors, electronic control

#### **Electrical system**

Alternator, dynamo, magneto, solid state, battery, coil, condenser, spark plug, spark plug leads, contact breakers. Fuses, lights, bulbs, relays

#### **Operation**

The way the above components work individually and as part of the system: force feed, splash feed, forced, thermo syphon

## Unit 307

# Understanding and Working with Land-based Vehicle Engine Technology

### Outcome 3

Be able to test and diagnose faults in land-based vehicle engines and their ancillary systems

#### Assessment Criteria

The learner can:

1. **Safely** carry out **testing procedures** using manufacturers' service data
2. **Report** on **status** of engine and **ancillary equipment**

#### Unit content

##### Safely

As required by recognised procedures and risk assessment

##### Testing procedures

Use of testing equipment, multi meter, power probe, ammeter, volt meter , resistance, continuity, voltage, compression, oil pressure, cooling system pressure, fuel pressure, anti freeze, engine power

##### Report

Written, verbal

##### Status

Serviceable, non serviceable, manufacturers specification, engine (2 stroke, four stroke, diesel, petrol)

##### Ancillary equipment

Alternator, dynamo, starter motor

## Unit 307

# Understanding and Working with Land-based Vehicle Engine Technology

## Outcome 4

Be able to maintain and repair land-based vehicle engines and their ancillary systems

### Assessment Criteria

The learner can:

1. Safely carry out (using manufacturers' service data) **routine maintenance** of engines and associated **ancillary equipment**
2. Safely service and repair selected **land-based engines** and **ancillary equipment**

### Unit content

#### Routine maintenance

Engine oil and filter change, fuel filter change, drive belt adjustment

#### Ancillary equipment

Starter motor, alternator, fuel pump

#### Service

Short term, long term

#### Land-based engines

Two stroke, four stroke, petrol, diesel

## **Unit 307                      Understanding and Working with Land-based Vehicle Engine Technology**

### **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 engines and their ancillary systems appropriate work context. The teaching will need to cover a range of two 7 four stroke engines, diesel and petrol appropriate to the learners background.

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, 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 delivery of this unit can take the form of classroom based sessions, workshop practical sessions, in work evaluation and assessment of the systems performance. The use of visiting speakers could also be beneficial to the delivery and the learner's knowledge and understanding. The engines and their ancillary equipment used should be with the agreement of the tutor but should be of equal complexity to ensure fairness of assessment.

In Outcome 1, the learner will need to understand and be able to explain the construction and operation of spark ignition engines, both two and four stroke and four stroke compression ignition engines. This will include the operating cycles for two and four stroke spark ignition engines and four stroke compression ignition engines. The learner will also understand the firing orders of various engine configurations, two cylinder, three cylinder, four cylinder, six cylinder. The learner will need to be able explain the function of internal components e.g. piston, crankshaft, connecting rod and camshaft.

In Outcome 2 the learner is required to understand and be able to explain the construction and operation of the engine lubrication system force and splash feed, the cooling system air and liquid, the fuel system petrol and diesel and the electrical system. For all of these the learner will need to understand and be able to explain the function of the system components for stroke engines both diesel and petrol and an appropriate two stroke engine.

In Outcome 3 the learner will be able to carry out appropriate tests on both two and four stroke engines and their ancillary equipment. After carrying out appropriate tests the learner will need to report on the status of the engine and the ancillary equipment and compare the results to the manufactures original specification.

In Outcome 4, the learner will be able to carry out routine maintenance and servicing of one two stroke engine, one four stroke petrol engine and one four stroke diesel engine and the associated equipment. The learner will need to describe and carry out repair procedures for the three engine types identified.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X
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- Manufacturers publications and manuals

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Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
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<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 308

# Inspect and Test Land-based Machinery and Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of inspections and tests to land-based equipment and their findings 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 inspect and test land-based machinery and equipment

### Learning outcomes

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

1. Be able to inspect and test land-based machinery and equipment
2. Be able to analyse and interpret findings
3. Understand how to inspect and test land-based machinery and equipment
4. Understand how to formulate and recommend actions

### 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 029NLEO30.

### 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 308

# Inspect and Test Land-based Machinery and Equipment

### Outcome 1

Be able to inspect and test land-based machinery and equipment

#### Assessment Criteria

The learner can:

1. Establish the **objectives of the inspection or test**
2. **Observe and record** information to evaluate the condition, application and performance of equipment
3. **Prepare** and carry out test(s)

#### Range

#### Test processes

Sensory, operational, simulation, comparison, isolation, logical elimination, diagnostic tests, portable Appliance Test (PAT)

#### Considerations

Economic viability, safety, timescale, longevity, productivity, unfit for purpose, legality, cause and effect, on-going monitoring, environmental

#### Repair classifications

Warranty, insurance claim, forced breakage, poor maintenance, unauthorised intervention, sabotage, vandalism, overload, abuse, inappropriate use

#### Unit content

#### Objectives of the inspection or test

Manufacturer's compliance, technical and legislative compliance, verification of repair, accident/incident, diagnosis, evaluation of condition

#### Observe and record

Observation, collation and recording of information to assist with inspection and testing activities, the evaluation of service histories, operating conditions and usage, symptoms, technical data, investigation of failed and worn parts

#### Prepare

Know the procedures to follow when preparing to carry out inspections and tests, establishing timescales and expectations, serviceability and suitability of test and inspection equipment

## Unit 308

# Inspect and Test Land-based Machinery and Equipment

## Outcome 2

Be able to analyse and interpret findings

### Assessment Criteria

The learner can:

1. **Check** that the **data** gathered is accurate and takes account of test conditions
2. Recognise the **cause and effect of failure/s**
3. **Analyse the data** using approved methods and procedures
4. **Present findings** and recommendations

### Range

#### Applications

Manufacturer's compliance, technical and legislative compliance, verification of repair, accident/incident, diagnosis and evaluation of condition

#### Tests processes

Sensory, operational, simulation, comparison, isolation, logical elimination, diagnostic tests

#### Considerations

Economic viability, safety, timescale, longevity, productivity, unfit for purpose, legality, cause and effect, on-going monitoring, environmental

#### Repair classifications

Warranty, insurance claim, forced breakage, poor maintenance, unauthorised intervention, sabotage, vandalism, overload, abuse, inappropriate use

### Unit content

#### Check data

Know how to confirm that collected and reference data is accurate, external factors that can influence the accuracy

#### Cause and effect of failures

Know how to establish and differentiate between the cause and effect of a failure,

#### Analyse the data

Know the approved methods used to accurately collect data, how to identify deviations against the manufacturer's specification and the implications these may have, establish the suitability and limitations of test equipment used in tests and inspections

#### Present the findings

Know how to compile recommendations, fitness for required purpose, methods of presenting the findings, (verbal, written, report, diagram, chart, and table)



## Unit 308

# Inspect and Test Land-based Machinery and Equipment

## Outcome 3

Understand how to inspect and test land-based machinery and equipment

### Assessment Criteria

The learner can:

1. Describe methods used to investigate **intermittent faults**
2. Describe the **causes and symptoms** of malfunctions
3. Describe the **methods, diagnostic and specialist equipment** used to **establish conformity** with manufacturer's, technical and legislation requirements
4. Describe the difference between a characteristic and a malfunction

### Range

#### Applications

Manufacturer's compliance, technical and legislative compliance, verification of repair, accident/incident, diagnosis and evaluation

#### Tests processes

Sensory, operational, simulation, comparison, isolation, logical elimination, information gathering

#### Considerations

Economic viability, safety, timescale, longevity, productivity, unfit for purpose legality, cause and effect, on-going monitoring, environmental

#### Repair classifications

Warranty, insurance claim, forced breakage, poor maintenance, unauthorised intervention, sabotage, vandalism, overload, abuse, inappropriate use

### Unit content

#### Intermittent faults

Know the methods and techniques used to investigate, diagnose and record intermittent faults

#### Causes and symptoms

Know how to differentiate between the cause and effect of a failure, how to establish the reasons for failure and the symptoms that they produce

#### Methods, diagnostic and specialist equipment

Know the test processes as listed in the range and how to apply them. The diagnostic equipment used in tests and inspections, their applications and limitations. Be able to explain how to analyse test data, interpret and present findings against manufacturer's specifications

## Unit 308

# Inspect and Test Land-based Machinery and Equipment

## Outcome 4

Understand how to formulate and recommend actions

### Assessment Criteria

The learner can:

1. Describe the **actions** that could be considered following inspection and testing **and their implications**
2. Explain how to **recognise** the need for **operator training requirements** to avoid reoccurrence of failures

### Range

#### Applications

Manufacturer's compliance, technical and legislative compliance, verification of repair, accident / incident, diagnosis and evaluation

#### Tests processes

Sensory, operational, simulation, comparison, isolation, logical elimination, information gathering

#### Considerations

Economic viability, safety, timescale, longevity, productivity, unfit for purpose, legality, cause and effect, on-going monitoring, environmental

#### Repair classifications

Warranty, insurance claim, forced breakage, poor maintenance, unauthorised intervention, sabotage, vandalism, overload, abuse, inappropriate use

### Unit content

#### Actions and their implications

Actions: replace, repair, modify, update, substitute, impound, beyond economic repair, service and maintenance, pass/ fail and unsafe

Implications: warranty, economic viability, integrity of repair, insurance, timescale, health and safety, Impact on dealership, customer and supplier, legislation, regulations, industry standards and manufacturer's guidelines

#### Recognise operator training requirements

Know how to identify the need for operator training and the effect this has on machinery and equipment performance.

## **Unit 308                    Inspect and Test Land-based Machinery and Equipment**

### **Notes for guidance**

This unit has been designed to provide learners with the knowledge, skills and understanding to enable them to undertake Inspection and Test operations on machinery and equipment found in land-based applications. At all times 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, 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.

In Outcome 1, delivery is likely to include a large practical content, which may include demonstrations and supervised practical workshop sessions. The learner will gain practical skills in inspecting and testing a range of machinery and equipment, recording the results, and comparing the recorded results with the correct specifications. It is important that delivery also covers the objectives for the observation or test, and how this can affect the recording of the outcomes.

In Outcome 2, delivery is likely to include a mixture of classroom based activities and practical demonstrations. Learners will need a range of test data and guidance on how to interpret and analyse data, and how it should be presented dependent on the test objectives and any other considerations. Delivery also needs to include the cause and effects of test and inspection failures, and how to check the accuracy of data collected.

Delivery of Outcomes 3 provides the underpinning knowledge and understanding for the practical activity in Outcomes 1 and 2, so it is important that close links are made.

In Outcome 3, the learner will gain an understanding of the methods used to investigate intermittent faults, the causes and symptoms of malfunctions, and how these differ from characteristics that are within the normal range for a particular piece of machinery or equipment. Learners also need to gain an understanding of the methods, diagnostic and specialist equipment used to establish conformity with manufacturer's/technical/legislation requirements. It will be beneficial for this to include a wide a range of diagnostic equipment as possible, perhaps by including visits to other specialist workshops. Delivery is likely to be predominantly through classroom based activities, supported by practical demonstrations and linked to Outcomes 1 and 2.

In Outcome 4, delivery is likely to include classroom based activity, learner research, use of case study material and discussion. Learners need to gain an appreciation of the range of actions that could be considered following testing and inspection, and their implications. They also need to gain an understanding of the types of failure that arise from operator error, and how this may be rectified by training.

Emphasis throughout the delivery of this unit should be placed on the use of a wide variety of tests and inspection equipment to evaluate machinery and equipment faults.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers publications and manuals

### Journals

- Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

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|--|--|
| <a href="http://www.bagma.com">www.bagma.com</a>                 | British Agricultural and Garden Machinery Association          |
| <a href="http://www.defra.gov.uk">www.defra.gov.uk</a>           | Dept for Environment, Food and Rural Affairs                   |
| <a href="http://www.wales.gov.uk">www.wales.gov.uk</a>           | Welsh Assembly Government                                      |
| <a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>     | Scottish Executive Environment and Rural Affairs Department    |
| <a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>         | Department of Agriculture and Rural Affairs (Northern Ireland) |
| <a href="http://www.hse.gov.uk">www.hse.gov.uk</a>               | Health and Safety Executive                                    |
| <a href="http://www.howstuffworks.com">www.howstuffworks.com</a> | How Stuff Works  |
| <a href="http://www.iagre.org">www.iagre.org</a>                 | Institution of Agricultural Engineers                          |

**Level:** 3

**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 aim of this unit is to provide learners with skills, knowledge and understanding to enable them to identify and carry out safe and efficient repair or replacements to worn or damaged land-based equipment components.

**Learning outcomes**

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

1. Know the importance of health and safety and safe working practices within a workshop environment
2. Be able to use hand tools, joining and cutting equipment commonly in land-based maintenance workshops
3. Understand selection and use of materials suitable for purpose
4. Be able to maintain, replace or repair worn or broken components in a land based situation

**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**

CU28 Prepare for and 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 309

### Outcome 1

## Undertaking Land-based Workshop Practice

### Know the importance of health and safety and safe working practices within a workshop environment

#### Assessment Criteria

The learner can:

1. Identify **potential hazards** in a land-based maintenance workshop
2. State the range of **legislations** and/or **codes of practice** that apply to given workshop operations
3. State **reasons for the need to follow legislation and safe working practices** in the workshop environment

#### Range

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

#### Unit content

##### Potential hazards

Fumes, sparks, combustion of materials, faulty equipment, blocked access/egress, lifting heavy components, unsafe working area, slipping, tripping, electric cables

##### Legislations

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

##### Codes of practice

Personal Protective Equipment (PPE), machine guarding, company health and safety policy, first aid policy, reporting procedures, personal hygiene facilities, housekeeping policies, waste storage/disposal policy, fire exits and procedures

##### Reasons for the need to follow legislation and codes of practice:

Personal health and safety, legal requirements, injury to bystanders, work efficiency, location of tools and equipment, accountability for work done

## Unit 309

### Outcome 2

## Undertaking Land-based Workshop Practice

Be able to use hand tools, joining and cutting equipment commonly in Land-based maintenance workshops

### Assessment Criteria

The learner can:

1. Identify a range of **hand tools** and joining and cutting equipment used in land-based maintenance workshops and state their purpose
2. Safely use a given range of hand tools and **joining** and cutting **equipment**
3. Demonstrate safe and correct **maintenance procedures** for a given range of
4. hand tools and joining and cutting equipment

### Range

Workshop where routine and non routine maintenance, fabrication and joining may be carried out at the same time

### Unit content

#### Hand tools

Hammers, spanners, wrenches, drivers, marking out tools, punches, pullers, measuring equipment

#### Joining equipment

Non-thermal: Riveting, adhesives, threaded fasteners

Thermal: manual metal arc, metal inert gas, oxy/acetylene, soldering

#### Cutting equipment

Hand and powered hacksaw, chisels, files, shears, bench and hand held grinders, drills, oxy/acetylene cutting

#### Maintenance procedures

Hand tool cleaning and storage, transportation, sharpening cutting tools, correct angles, replacement grinding/cutting discs, electrical equipment observation, electrical testing requirements

**Unit 309**  
Outcome 3

**Undertaking Land-based Workshop Practice**  
Understand selection and use of materials suitable  
for purpose

**Assessment Criteria**

The learner can:

1. Identify a range of **materials** commonly used for the repair of land-based equipment
2. **Justify the selection of material(s)** to meet given repair objectives
3. **Compare** the use of selected **materials** for given repair situations

**Unit content**

**Materials**

Metallic: iron, steel, copper, brass, aluminium, cast iron, lead, bronze

Non-metallic: wood, rubber, plastics, fibres, paper

**Justify the selection of material(s)**

Ease of use, cost, surface finish, self lubrication, weight, resistance to wear, oxidation resistance, conductivity, heat resistance

**Compare materials**

Hardness, brittleness, ductility, workability, strength, cost, durability



**Unit 309**  
Outcome 4

**Undertaking Land-based Workshop Practice**  
Be able to maintain, replace or repair worn or broken components in a land-based situation

**Assessment Criteria**

The learner can:

1. Inspect a selected land-based machine to identify the need for safe repair or **replacement** of identified worn or damaged components
2. Prepare tools and materials and safely **repair** or replace worn or damaged land-based equipment components to meet given specifications
3. Make recommendations for possible **changes to repair and component replacement procedures** carried out on a selected land-based machine

**Range**

Choose from the following, plough, cultivation machine, grass cutting machine, planting/sowing/spreading machine

**Unit content**

**Replacements**

Worn components, damaged components, bearings, bushes, seals

**Repairs**

Broken welds, framework fractures, re-alignments, re-fabrications

**Changes to repair and component replacement procedures**

Strengthening of weak areas, heavier duty materials, gussets, braces, manufacturer updates/modifications to wearing components, improvement to lubrication, reduction of vibration, spreading load

Recommendations for changes to procedures: to reduce time, save costs, improve working conditions, improve longevity, and improve effectiveness

## Unit 309                      Undertaking Land-based Workshop Practice

### Notes for guidance

This unit is designed to give the learners the necessary knowledge and skills to detect and rectify faults on a range of land-based equipment typical to their area of study. A suggested range is listed in the range/scope details in outcome four.

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 manufacturer's handbooks should be emphasised throughout both for the equipment to be repaired and maintained and also for the tools and equipment used.

Outcome 1 enables the learner to demonstrate an awareness of health and safety issues which affect themselves and others in the workshop situation. An understanding of codes of practice and company policies must also be understood. The learner will also be required to identify potential hazards in a maintenance workshop and ways of minimising those hazards. An understanding of the legislation covering workshop activity and equipment maintenance is also necessary, as is the need for safe working practices and the identification of safe systems of work. The learner must be aware of the required personal protective equipment Personal Protective Equipment (PPE) required for a task and this must be provided and worn; potential risks must be minimised.

Outcome 2, learners will be able to identify a range of hand-tools, joining and cutting equipment. The learner will be able to select and safely and efficiently use appropriate tools and equipment for given tasks. These tasks will include both the use of hand-tools and equipment for thermal and non-thermal joining. All tools used will be inspected, maintained and correctly stored by the learners for subsequent use. It is essential that the learner wears the appropriate (PPE) and adheres to safe working practice.

Outcome 3, learners will be able to identify a range of materials and select the most appropriate material to complete a repair process. The learner will need to understand material properties to be able to make the appropriate choice. Materials to be identified and their properties understood include both metallic and non-metallic material such as plastics and rubber. Selection factors will include ease of working and cost as well as inherent properties such as ductility, strength and hardness. The learner will be able to compare different materials and their possible uses.

Outcome 4, requires the learner to be able to maintain equipment and to replace or repair worn or broken components. The learner must demonstrate safe practices, and conform to legislation while undertaking selected repair/replacement tasks. On completion of the tasks learners will verify their own work and comment on alternative replacement/repair strategies, should the problem reoccur.

Throughout the unit the emphasis will be on safe, legal practices, working to employers' recommended procedures and attention to detail when verifying completed work.

It is accepted that some formal lectures will be necessary, however it is recommended that these are linked to considerable interactive practical lessons in a real working environment.

Centres are encouraged to introduce employers and specific professionals to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of workshops and dealers to add depth to the learner's experience.

## References

### Books

Bell, B. 1992. *Farm Workshop*. 2<sup>nd</sup> ed. Ipswich: Farming Press. ISBN 0852362374

Farmers Weekly. 1979. *Farm Workshop and Maintenance*. 2<sup>nd</sup> ed. London: Crosby Lockwood. ISBN 0246120193.

Pearce, A. 2007. *Farm and Workshop Welding*. 2<sup>nd</sup> ed. Ipswich: Old Pond Publishing. ISBN 1905523300.

### Journals

Profi International

Farmers Weekly

Farm Ideas

### Websites

[www.hse.gov.uk](http://www.hse.gov.uk)

[www.twi.co.uk](http://www.twi.co.uk)

Health and Safety Executive

The welding Institute

## Unit 310

# Maintain Electronic Control and Monitoring Systems on Land-based Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the skills required to maintain electronic control and monitoring 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 to maintain electronic control and monitoring systems on land based equipment.

### Learning outcomes

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

1. Be able to maintain electronic control and monitoring systems
2. Understand how to maintain electronic control and monitoring systems

### 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 029NLEO23

### 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 310                      Maintain Electronic Control and Monitoring Systems on Land-based Equipment**

**Outcome 1**                      Be able to maintain electronic control and monitoring systems to meet manufacturer's specifications

### **Assessment Criteria**

The learner can:

1. Identify and locate, **electronic control and monitoring systems** and their components to retrieve and interpret stored information
2. **Establish parameters**, calibrate and verify performance of the electronic control and monitoring systems
3. **Maintain electronic control and monitoring systems** and their components to confirm integrity
4. Prepare the system to be tested and **carry out a diagnostic test** using diagnostic tools and equipment to evaluate or rectify system performance

### **Range**

#### **Electrical control and monitoring systems**

Engine, transmission and headland management, performance monitoring, CCTV monitoring, equipment instrumentation, operator information, suspension control, hydraulic control, pilot steering, global positioning, multiplexing, telemetry automatic guidance systems

#### **Technology**

CAN bus, ISO bus, GPS satellite, wireless, pulse width modulation (PWM)

#### **Components**

Transistors, capacitors, regulators, resistors, diodes, transformers, thermostats, transducers, transmitters, receivers, actuators electronic control units (ECU)

### **Unit content**

#### **Electronic control and monitoring systems**

The identification and location of control and monitoring systems and their components, the methods and techniques used to retrieve, interpret and download fault codes and stored information following manufacturer's technical information and specifications

#### **Establish parameters**

Methods, techniques and equipment used to establish parameters, calibrate and verify performance of control and monitoring systems to comply with manufacturer's specifications.

#### **Maintain electronic control and monitoring systems**

Methods used to maintain the integrity of control and monitoring systems and their components in line with manufacturer's instructions e.g. condensation control, prevention of corrosion, dry joints

#### **Carry out a diagnostic test**

Methods used to prepare control and monitoring systems prior to test and diagnosis operations, carry out diagnostic tests using appropriate equipment and diagnostic tools to evaluate / rectify system performance; identifying software versions and access upgrade information

## Unit 310

# Maintain Electronic Control and Monitoring Systems on Land-based Equipment

### Outcome 2

Understand how to maintain electronic control and monitoring systems

#### Assessment Criteria

The learner can:

1. **Summarise** electronic **control and monitoring systems** and their application
2. Summarise **how** control and monitoring **signals are generated** and **communicated**, and the **causes and effects of interference**
3. Summarise the **function of electronic components**
4. Describe the **tools and equipment** used to test, repair and reinstate electronic control and monitoring systems and their components
5. Describe the methods used to check and **maintain system integrity**
6. Summarise how to **retrieve, interpret, reinstate and verify** information stored in electronic control units (ECU)

#### Range

##### Electrical control and monitoring systems

Engine, transmission and headland management, performance monitoring, CCTV monitoring, equipment instrumentation, operator information, suspension control, hydraulic control, pilot steering, global positioning, multiplexing, telemetry automatic guidance systems

##### Technology

CAN bus, ISO bus, GPS satellite, wireless, Pulse width modulation (PWM)

##### Components

Transistors, capacitors, regulators, resistors, diodes, transformers, thermistors, transducers, transmitters, receivers, actuators electronic control units (ECU)

#### Unit content

##### Summarise control and monitoring systems

Control and monitoring systems, their operation, functions and applications

##### How signals are generated, communicated and the effects of interference

The types of signals used to communicate electronic information in control and monitoring equipment, how signals are generated and communicated, causes and effects of externally generated interference and how to inhibit interference for example screening, twisted pairs, grounding/earthing

##### Function of electronic components

Know the identity, application and function of all the electronic components listed in the components range list

##### Tools and equipment

Multi meters, oscilloscopes, internal and external electronic interrogation equipment, sources of technical assistance and information

##### Maintain system integrity

Understand the threats of electronic system integrity for example connections, routing of wiring and fixings, grounding and earthing



**Retrieve, interpret, reinstate and verify**

Know how to calibrate and verify the correct operation of control and monitoring equipment, procedures and methods of retrieving ECU stored information, how to record, reinstate and verify stored information

## **Unit 310                      Maintain Electronic Control and Monitoring Systems on Land-based Equipment**

### Notes for guidance

This unit is designed to provide the learners with the knowledge, skills and understanding of how to maintain, diagnose and reinstate electronic control and monitoring systems used in land-based equipment.

This is an important unit as the presence of electronic control, monitoring and diagnostic systems plays a major role in modern land-based equipment. Every opportunity must be taken to expose the learner to a wide range of systems to enhance their confidence in this area. Particular attention needs to be taken of the range within this unit. It is important that health and safety, risk assessment, the use of appropriate PPE and safe working practices are emphasised throughout delivery of this unit.

Delivery of Outcome 1 is likely to include a range of methods, including classroom based activities, workshop practical's and visits to see a range of electronic control and monitoring systems in use. Learners will need sufficient time to develop their practical skills, particularly in calibrating and verifying performance and diagnostic testing. Particular attention needs to be paid to using the results of diagnostic testing to evaluate system performance.

In Outcome 2 learners need to gain a knowledge and understanding of control and monitoring systems and the function of the range of electronic components. Delivery also needs to encompass the range of tools and equipment, which should include first hand experience of as many of these as is feasible. Delivery of the methods used to maintain system integrity and how to retrieve, interpret, reinstate and verify information could be achieved through case study material and by close links to the practical delivery in Outcome 1.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

# Unit 311                      Service and Repair Suspension Systems on Land-based Equipment

**Level:**                      3

**Credit value:**        5

## **Unit aim**

This unit aims to provide learners with an understanding of the construction, function and operation of suspension 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 service and repair suspension systems and components on 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 suspension systems and their components
2. Understand the construction, function and operation of suspension 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 029NLEO21.

## **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 311                      Service and Repair Suspension Systems on Land-based Equipment**

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

### **Assessment Criteria**

The learner can:

1. **Remove, dismantle, repair and reinstate** suspension systems and components to manufacturer's specifications
2. **Diagnose faults** in suspension assemblies and their components and recommend action

### **Range**

#### **Assemblies**

Cab suspension, seat suspension and axle suspension

#### **Components**

Cab mounts, dampers, springs, accumulators, levelling devices

### **Unit content**

#### **Remove, dismantle repair and reinstate**

Safely release stored energy from suspensions assemblies and their components

#### **Diagnose faults**

Diagnostic tests, equipment, interpret diagnostic test results and recommend appropriate repair options

## **Unit 311**                    **Service and Repair Suspension Systems on Land-based Equipment**

Outcome 2                    Understand the construction, function and operation of suspension systems

### **Assessment Criteria**

The learner can:

1. Describe the **types, construction and operating principles** of suspension assemblies and their components
2. Describe how to **remove, dismantle, repair and reinstate** suspension assemblies and components
3. Describe how to **diagnose faults** in suspension assemblies and components and recommend action

### **Range**

#### **Assemblies**

Cab suspension, seat suspension and axle suspension

#### **Components**

Cab mounts, dampers, springs, accumulators, levelling devices

### **Unit content**

#### **Types, construction and operating principles**

Cab mounts, dampers, springs, accumulators, levelling devices, cab and seat

#### **Remove, dismantle, repair and reinstate**

Know how to safely release stored energy from suspensions assemblies and their components to manufacturers specifications

#### **Diagnose faults**

Know how to select and use the appropriate diagnostic tools and tests to diagnose suspension assembly and component faults, how to interpret diagnostic test results and recommend appropriate repair options

## Notes for guidance

This unit has been designed to provide learners with the knowledge, skills and understanding to enable them to undertake service, maintenance and repair operations on suspension system found on land-based equipment. At all times an emphasis must be placed on safe working practices and current legislation. It is important that all maintenance takes place according to manufacturers' specifications.

Centres and tutors need to be aware of the need to safeguard 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.

In Outcome 1, learners gain skills in removing, dismantling, repairing and reinstating suspension systems and components, and in diagnosing faults and recommending actions. It will be important that learners have sufficient supervised practical experience, with appropriate tools and equipment, to work on a range of suspension systems and components.

In Outcome 2, learners gain knowledge of the types of suspension assemblies, their construction and operating principles. This unit provides the underpinning knowledge and understanding for delivery of Outcome 1, so it would be helpful if delivery is closely linked. Delivery is likely to include a range of classroom based activities, including the use of case study material to help learners develop skills in fault diagnosis.

## References

### Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X  
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Farmers Weekly

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<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
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<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers



## Unit 312

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

**Level:** 3

**Credit value:** 5

### Unit aim

This unit aims to provide learners with an understanding of construction, function and operation of 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 to carry out service and repair on 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 components
2. Understand 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 029NLEO25.

### 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 312

# 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 components

#### Assessment Criteria

The learner can:

1. **Inspect** performance of pneumatic **systems** and components
2. Prepare system to be tested and **carry out tests** using diagnostic tools
3. **Interpret and record** the test results and recommend action
4. Remove, dismantle, repair and reinstate system and components to manufacturers' specification

#### Range

##### Pneumatic systems

Air braking, suspension and compressed air systems

##### Components

Compressors, regulating valves, relief valves, dump valves, pressure control valves, handbrake and foot brake valves, diaphragm valves, air activated cylinders, actuators, air cushions, fail safe system components, air receivers and driers

#### Unit content

##### Inspect systems

Methods of inspection, performance standards

##### Carry out tests

Select appropriate diagnostic tools and equipment to assess performance and conduct diagnostic tests

##### Interpret and record

Methods of recording, methods of interpretation, importance of accuracy, recommendations of the actions to be taken

## Unit 312

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

### Outcome 2

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

#### Assessment Criteria

The learner can:

1. **Interpret circuit diagrams** and symbols and their functions within a pneumatic system
2. Explain the **application and function** of pneumatic systems and components
3. Explain **diagnostic tests** and how to interpret the results
4. Describe how to dismantle, repair and reinstate pneumatic systems and components

#### Range

##### Pneumatic systems

Air braking, suspension and compressed air systems

##### Components

Compressors, regulating valves, relief valves, dump valves, pressure control valves, handbrake and foot brake valves, diaphragm valves, air activated cylinders, actuators, air cushions, fail safe system components, air receivers and driers

#### Unit content

##### Interpret circuit diagrams

The function and relationship of their components to one another and the international symbols used, purpose of circuit diagrams

##### Application and function

Air compressors, air pressure regulating valves, relief valves, dump valves, air pressure control valves, hand brake valves, foot brake valves, diaphragm operated valves, air activated cylinders, air cushions, fail-safe/ emergency system components, air receivers and driers

##### Diagnostic tests

Know and be able to justify test methods and techniques, diagnostic equipment and its application to evaluate system and component performance within manufacturer's specification.

# **Unit 312                    Service and Repair Pneumatic Systems and Components for Land-based Equipment**

## **Notes for guidance**

This unit is designed to provide the learners with the knowledge, skills and understanding of how to maintain/diagnose/reinstate pneumatic systems and their components used in land-based equipment.

Every opportunity must be taken to expose the learner to a wide range of systems to enhance their confidence in this area. Particular attention needs to be taken of the range within this unit. Emphasis should be placed on the evaluation and verification of pneumatic system performance and the methods used to compile recommendations of repair options. All maintenance must be carried out according to manufacturers' specifications and current legislation.

At all times the use of safe working practices and compliance with current legislation must be reinforced. Centres and tutors need to be aware of the need to safeguard 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.

In Outcome, 1 learners need to develop skills in inspecting, testing and servicing a range of pneumatic systems using appropriate tools and equipment. Learners also need to gain skills in interpreting the results of diagnostic tests and recommending suitable actions. It is anticipated that most of the delivery time will be practical, including supervised workshop practice, demonstrations and links to appropriate work experience placement activity.

In Outcome 2, learners need to gain the underpinning knowledge and understanding, including methods of servicing pneumatic systems, their application and function and the interpretation of circuit diagrams. Case study material will be helpful in enabling learners to interpret the results of diagnostic tests and explain their purpose. It is likely that delivery will include classroom based activities and links to workshop practice completed in Outcome 1.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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## Unit 313

# Service and Repair Powershift, Hydrostatic and CVT Transmissions on Land-based Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the construction, function and operation of powershift hydrostatic, CVT transmissions 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 carry out service and repair on powershift, hydrostatic, CVT transmission on 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 powershift, hydrostatic and CVT transmissions and their components
2. Understand the construction, function and operation of powershift, hydrostatic, CVT transmissions 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 029NLEO27.

### 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 313                      Service and Repair Powershift, Hydrostatic and CVT Transmissions on Land-based Equipment**

Outcome 1                      Be able to perform service and repair operations on powershift, hydrostatic and CVT transmissions and their components

### **Assessment Criteria**

The learner can:

1. Identify **transmissions** and their **components**
2. **Remove, dismantle, repair and reinstate** transmission to manufacturer's specification and standards
3. Perform **operational and diagnostic tests** identifying and categorising **faults** in transmission

### **Unit content**

#### **Transmissions**

Powershift, Hydrostatic, CVT

#### **Components**

Clutches, gears, drive shafts, Hydraulic pumps and motors, planetary assemblies, brakes

#### **Operational and diagnostic tests**

Mechanical, hydraulic, electrical/electronic, operator use

#### **Faults**

Record faults and recommend appropriate action

## Unit 313

# Service and Repair Powershift, Hydrostatic and CVT Transmissions on Land-based Equipment

## Outcome 2

Understand the construction, function and operation of powershift, hydrostatic, CVT transmissions and their components

### Assessment Criteria

The learner can:

1. **Interpret** technical documentation relating to transmissions to perform **diagnostic tests**
2. Explain the different types of transmissions including layout, construction, **operating principles** and function
3. Describe how to remove, dismantle, repair and reinstate powershift, hydrostatic, CVT transmissions and their components
4. Evaluate **faults** in powershift, hydrostatic and CVT transmissions using operational and diagnostic test data

### Range

#### Transmissions

Powershift, Hydrostatic, CVT

#### Components

Clutches, gears, drive shafts, Hydraulic pumps and motors, planetary assemblies, brakes, torque limiting devices

### Unit content

#### Interpret

Be able to read and understand information supplied by the manufacturer

#### Diagnostic tests

Drive paths, shift and engagement patterns, stationary and rotating components, fault codes, monitoring intermittent faults, simulation, substitution, operational tests

#### Operating principles

Speed sequencing or matching, directional change or shuttle components, range change and variable speed components, speed monitoring devices, transmission clutching and braking components, single and multi epicyclic units, variable and fixed displacement pumps, hydrostatic motors, safety and protection devices, operational limitations (stationary work, towing, bump starting, engine braking)  
Diagnostic Tests mechanical, hydraulic, electrical/electronic

#### Faults

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



## **Unit 313                      Service and Repair Powershift, Hydrostatic and CVT 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 an appropriate work context. Delivery will need to cover a range of mechanical transmission systems appropriate to the learners' backgrounds and the needs of the land-based engineering sector.

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 and manufacturers' specifications as appropriate.

Centres and tutors need to be aware of the need to safeguard 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.

Delivery of this unit can take the form of classroom based sessions, workshop practical sessions, visits to workshops and the use of work experience placements. The use of visiting speakers may also be considered.

For Outcome 1 delivery is likely to have a practical bias, including workshop sessions and demonstrations. It will be beneficial if delivery is closely linked to the underpinning knowledge and understanding found in Outcome 2. Learners will need the opportunity to handle a range of transmission components, enabling them to identify them and the corresponding transmissions. Learners will also need sufficient practical time to develop their skills in removing, dismantling, repairing and reinstating transmissions and performing operational and diagnostic tests. Whilst assessment is based around one transmission system, it is important the delivery includes some coverage of all those in the range.

For Outcome 2, delivery is likely to include classroom based activities and supervised practical workshop sessions. The learner will gain an understanding of the construction, function and operation of powershift, hydrostatic and transmissions and their components, including drive paths shift and engagement patterns stationary and rotating components. Delivery also needs to cover the operational limitations of each transmission system, including stationary working, towing, bump starting and engine braking. Learners also need to gain an understanding of the methods and procedures of removing, dismantling, repairing and reinstating transmission systems, which is likely to link closely to the practical activity in Outcome 1. It will be helpful for learners to be able to experience a range of technical information, enabling them to determine which diagnostic tests and required. Learners also need to be able to use test data to evaluate faults: this could be real workshop data or case study material.

## References

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Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X  
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## Unit 314

# Monitor the Handover and Installation of Land-based Equipment

**Level:** 3

**Credit value:** 5

### Unit aim

This unit aims to provide learners with an understanding of the principles of performing the handover and installation of 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 prepare for and handover the installation of land-based equipment

### Learning outcomes

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

1. Be able to perform the handover and installation of land-based equipment
2. Understand how to perform the handover and installation of land-based equipment

### 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 029NLEO29.

### 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 314

# Monitor the Handover and Installation of Land-based Equipment

### Outcome 1

Be able to perform the handover and installation of land-based equipment

#### Assessment Criteria

The learner can:

1. **Identify a suitable location**, agree and prepare for handover and installation with customer
2. **Use the correct procedure** to handover and install the equipment as specified
3. Use an appropriate format to **record the results of the installation**

#### Range

##### Equipment and machinery types

Hand held, pedestrian, self propelled, fixed equipment, trailed and mounted equipment

#### Unit content

##### Identify a suitable location

Know how to arrange and confirm an installation or handover appointment, criteria required when selecting a suitable installation and handover site (sufficient space, ownership, safety considerations) personal limitations, considerations, equipment and support materials are required to enable a successful installation or handover, examples of unsuitable locations

##### Use correct procedure

Introduction to the equipment, legal requirements, operation and control techniques, safe operating practices, limitations of use, explanation of operator's handbook, operational settings, performance and efficiency, demonstration, service and maintenance requirements, warranty terms and conditions, establish the operator's competence and understanding, effective communication skills, professional standards (for example courtesy, dress, language)

##### Record the results of the installation

Identify the documentation required when carrying out an installation and handover, the information that must be recorded and the recipients of copies of the documentation, the importance of accuracy, recording formats

## **Unit 314                      Monitor the Handover and Installation of Land-based Equipment**

**Outcome 2                      Understand how to perform the handover and  
installation of land-based equipment**

### **Assessment Criteria**

The learner can:

1. Identify the reasons and **benefits of handover and installation** of products
2. Describe how to carry out an installation using a **systematic process and** the relevant **quality control systems** including special machine characteristics
3. Describe technical advice and assistance within **limits of own authority and how to deal with queries and problems**

### **Range**

#### **Equipment and machinery types**

Hand held, pedestrian, self propelled, fixed equipment, trailed and mounted equipment

### **Unit content**

#### **Benefits of handover and installation**

Legal, safety, performance and economy, reliability, efficiency, professionalism, customer care, customer perception of after sales service

#### **Systematic process and quality control systems**

Introduction to the equipment, legal requirements, operation and control techniques, safe operating practices, limitations of use, explanation of operator's handbook, operational settings, performance and efficiency, demonstration, service and maintenance requirements, warranty terms and conditions, establish the operator's competence and understanding, use of supporting materials, documentation, recording and quality control systems required

#### **Limits of own authority and how to deal with queries**

Procedures for dealing with queries and unexpected problems, the extent of personal authority and responsibility (for example technical, financial, warranty, handling complaints), the implications of giving information and advice beyond authorised limits (for example personal and corporate liability), procedures where outside authority, for example referral to supervisor

# Unit 314                      Monitor the Handover and Installation of Land-based Equipment

## Notes for guidance

This unit has been designed to provide learners with the knowledge, skills and understanding to enable them to undertake the handover and installation of new or second-hand machinery and equipment supplied within the land-based industry. At all times an emphasis must be placed on safe working practices and current legislation, particularly care must be taken to ensure the understanding of the legal responsibility and personal liability.

For Outcome 1 delivery is likely to include classroom based activities, visits to observe handovers and installation of land-based equipment, and practice using simulated handovers and installations. Learners should also be taught how to record the results, and where these records should be shared and stored. During the delivery of this unit learners should be given guidance on the ability to express themselves clearly when delivering the installation and handover information. Assessment of the practical aspects of installation and handover tasks can be simulated where the learner demonstrates the processes of installation to an observer using available machines and equipment.

For Outcome 2, delivery is likely to include a range of classroom based activities and a guest speaker involved in handover and installation would be on benefit. Learners need to gain a good understanding of the benefits and purpose of handover and installation, and how these can affect machine performance, organisational liability and customer perception. Delivery also needs to ensure that learners are clear about the limits of their own authority, and how to deal with queries and problems. Simulations and role plays may assist delivery of this aspect of the unit.

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Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
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How Stuff Works  
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## Unit 315

# Operate and Service Land-based Vehicle Transmission Systems

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in transmission systems used in land based vehicles and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the layout and function of land-based transmission systems
2. Be able to operate land-based vehicle transmission systems
3. Be able to maintain land-based vehicle transmission systems
4. Be able test and repair land-based transmission systems

### 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 Land-based service engineering NOS.

### 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 315                    Operate and Service Land-based Vehicle Transmission Systems**

**Outcome 1                    Understand the layout and function of land-based transmission systems**

### **Assessment Criteria**

The learner can:

1. Illustrate the **layouts** of a given range of **land-based vehicle transmission systems**
2. Explain the **function** of a range of land-based vehicle transmission systems
3. Evaluate the **effectiveness** of different land-based transmission systems and explain the **work situations** to which each would be most suited

### **Unit content**

#### **Layout**

Pictures, flow diagram, illustrations, including clutch, gearbox, final drive

#### **Land-based vehicle transmission systems**

Two wheel drive, four wheel drive, hydrostatic drive, CVT drive (belt and gear/hydrostatic), power take off systems, track layer

#### **Function**

How the transmission transfers power (gears belts hydrostatics)

The ratio difference between the speed, torque and power of the input into the transmission, compared to the output of the transmission.

How the ratio can be and is changed by operator

#### **Effectiveness**

Efficiency (input power compared to out put power), economy (cost of purchase, cost of running), where each transmission is best suited for each work situation

#### **Work situations**

Work carried out, type of surface (field, road), land type (sand, clay, chalk etc), speed required, amount of ground interaction (compaction, grip, traction)

## Unit 315

# Operate and Service Land-based Vehicle Transmission Systems

## Outcome 2

Be able to operate land-based vehicle transmission systems

### Assessment Criteria

The learner can:

1. Carry out **land-based vehicle transmission systems** operations in given **situations**
2. Report advantages and disadvantages of selected land-based transmission systems
3. Explain the **working principles** of selected land based transmission systems

### Unit content

#### Land based vehicle transmission systems

Two wheel drive, four wheel drive, hydrostatic drive, CVT drive (belt and gear/hydrostatic), power take off systems, track layer

#### Situations

Land work, road work, stationary power supply (power take off)

#### Working principles

Ratio of speed torque, power loss, how the power is transmitted by each transmission

## **Unit 315                    Operate and Service Land-based Vehicle Transmission Systems**

**Outcome 3                    Be able to maintain land-based vehicle transmission systems**

### **Assessment Criteria**

The learner can:

1. Perform **scheduled maintenance operations** to **land-based vehicle transmission systems** in accordance with manufacturers' recommendations
2. Carry out a **calibration procedure**, using manufacturers recommended procedures, on a selected land-based transmission system
3. Produce a **report** outlining the effects of incorrect maintenance and calibrations of land-based transmission systems

### **Unit content**

#### **Scheduled maintenance operations**

Routine maintenance, planned wearing component replacement

#### **Land based vehicle transmission systems**

Two wheel drive, four wheel drive, hydrostatic drive, CVT drive (belt and gear/hydrostatic), power take off systems, track layer

#### **Calibration procedure**

Mechanical and electronic setting up of gearbox to ensure smooth efficient working

#### **Report**

Written, illustrated, video

## Unit 315

# Operate and Service Land-based Vehicle Transmission Systems

### Outcome 4

Be able test and repair land-based transmission systems

#### Assessment Criteria

The learner can:

1. Carry out risk assessments prior to performing **repair and test procedures to land based transmission systems**
2. Carry out repair and **test procedures** to selected land based transmission systems using manufacturers recommended procedures
3. Demonstrate and evaluate the use of **specialist tools and test equipment** used to carry out repair and test procedures on land based vehicle transmission systems

#### Unit content

##### Repair and test procedures

Inspect, remove, disassemble, repair, rebuild, and reinstate transmission units

##### Land based vehicle transmission systems

Two wheel drive, four wheel drive, hydrostatic drive, CVT drive (belt and gear/hydrostatic), power take off systems, track layer

##### Test procedures

Visual, audible, hydraulic pressure test (solenoids hydrostatics etc.), electronic signal test (solenoids switches etc), road test, dynamometer test

##### Specialist tools and test equipment

Feeler gauges, precision measuring equipment, spring balance, hydraulic pressure/flow gauges, computer and manufacturers software, temperature gauge

## **Unit 315                      Operate and Service Land-based Vehicle Transmission Systems**

### **Notes for guidance**

This unit explores the layout, function, operation, maintenance, repair and testing of modern land based transmissions. A full selection of transmissions, are to be covered to allow the learner to fully understand land based transmissions.

Centres and tutors need to be aware of the need to safeguard learners, when delivering and assessing units where the operation and servicing of machinery is involved. This unit requires the learner to undertake machinery servicing 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.

Outcomes 1 and 2 are closely linked and can be taught together. The majority of these Outcomes are lecture and workshop based and would benefit from good demonstrations and practicals. The operation part must be carried out over a range of circumstances and situations to allow the learner to appreciate when and where certain transmissions work better than others.

Outcome 3 covers schedule maintenance of the differing types of land-based transmission systems. This will involve servicing and adjusting the transmissions, as well as calibration of these transmissions. The calibration and settings of some transmissions may involve using specialist equipment or knowledge, only available to manufacturer's dealers. It may be necessary and the delivery of the Outcome could benefit from manufacturers/dealer personnel to demonstrate this part of the unit allowing the learner to understand how and why such operations are carried out.

Outcome 4 covers the testing and repair of land based transmissions. The test procedures used depends on the type of transmissions tested. For modern computer controlled transmissions part of the unit could be demonstrated at the same time as the calibration part of Outcome 3 by dealer/manufacturers staff. Part of this outcome is the production of a risk assessment prior to any test or repair; centres must ensure that the student is aware of any risks involved during these procedures.

The delivery of these Outcomes would mainly workshop practical based. Throughout the unit the emphasis is on acceptable health and safety procedures and safe working practices

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<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

**Level:** 3

**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 learners will study the purpose and operation of land-based machines including machine layout, systems and controls. They will explore daily checks and adjustments as well as appropriate Personal Protective Equipment and the legal and recommended requirements for land-based machinery. They will learn how to safely operate and maintain machinery and consider the different conditions in which machinery might need to operate.

**Learning outcomes**

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

1. Understand the purpose and operation of land-based machines
2. Be able to prepare land-based machines ready for work
3. Be able to safely operate land-based machinery
4. Be able to carry out operator maintenance and simple repairs

**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**

CU28 Prepare for and 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 316

### Outcome 1

## Undertaking Land-based Machinery Operations

Understand the purpose and operation of land-based machines

### Assessment Criteria

The learner can:

1. Explain the purpose and **safe operation** of selected land-based machines
2. Discuss the **differences between selected land-based machines**

### Range

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

### Unit content

#### Safe operation

Need for operator training, certification process, Health and safety at Work etc Act 1974, Provision and Use of Work Equipment Regulations 1998 (PUWER), Environment Act 1995, Control of Substances Hazardous to Health 2002 (COSHH), Personal Protective Equipment (PPE), manual handling, risk assessments, codes of practice

#### Differences between Land-based machines

Trailed or mounted, powered or non powered, mechanical, electric or hydraulic powered, wheels, skids or hydraulic pressure accumulation, cutting, gathering, conveying; belts, chains, shaft drives; vacuum, pressure, gravity; swath width, bout width, row width, depth control



## Unit 316

### Outcome 2

## Undertaking Land-based Machinery Operations

### Be able to prepare land-based machines ready for work

#### Assessment Criteria

The learner can:

1. **Prepare selected land-based machinery** ready for work safely
2. Review the **pre-start checks** and **safety requirements** for selected land-based machinery

#### Range

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

#### Unit content

##### Prepare selected land-based machines

Power unit suitability, removal from storage, cleaning, damage inspection, correct hitching, free movement of working components/controls, connection to power unit, wheel and tyre maintenance, braking and lighting requirements, lubrication, calibration, tying/wrapping materials, initial field settings

##### Pre-start checks

Power drive shaft condition, decontaminated, safety overload devices, fuel/oil requirements, tyre pressures and conditions, lighting controls including brakes, belt tensions

##### Safety requirements

Guards, safety rails, steps, safe attachment to power unit, component security, information decals

**Assessment Criteria**

The learner can:

1. **Operate** selected land-based machinery to meet given objectives safely
2. Explain the **safe operation** of selected land-based machinery

**Range**

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

**Unit content**

**Operate**

Site risk assessments, PPE, operator instruction manual, data sheets, transport/field settings, calibration check, correct power engagement, correct machine speeds, safe/correct loading of materials, machine output checks/quality of work, field procedures, terrain, ground conditions/undulations, public access

**Safe operation**

Health and Safety at Work etc Act (1974) follow manufacturers' recommendations, dealer installation process, operator instruction manuals and manufacturer web sites

**Unit 316**  
Outcome 4

**Undertaking Land-based Machinery Operations**  
Be able to carry out operator maintenance and simple repairs

**Assessment Criteria**

The learner can:

1. Carry out **operator maintenance** and appropriate **repairs** for selected land-based machinery
2. Assess **potential faults** and/or **defective parts** on a given land-based machine

**Range**

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

**Unit content**

**Operator maintenance**

Manufacturers' service schedules/instructions, lubrication, cleaning, assessment of wear tolerances, component replacement disposal of waste

**Repairs**

Framework welds, joints, distortion, fractures, leaking pipes, connections

**Potential faults**

Uneven groundwork, crop damage, inaccurate outputs, incorrect linkage settings, incorrect drawbar settings, uneven tyre pressures, incorrect track widths, power unit unsuitable, blockages

**Defective parts**

Belts, chains, bearings, loose splines, shares/tines, blunt/missing knives, rotor balance, nozzles/filters, and seals

## Unit 316                      Undertaking Land-based Machinery Operations

### Notes for guidance

This unit is designed to give learners knowledge, understanding and practical skills to enable them to recognise and understand the working principles of land-based machines typically used in their area of study.

Learners will be able to demonstrate pre start checks, initial settings and safe start up techniques for a range of selected machines prior to connecting the machine to a suitable power unit and preparing machine and power unit for work. An emphasis will be put on the correct use of manufacturers' recommended procedures and respect for health and safety issues and conformation of relevant safe working practices.

It is envisaged that all learners, prior to studying this unit will have received training in the use of tractors and have been assessed as having reached a level of competence to allow practical tasks to be demonstrated safely. Learners must show awareness and consideration of hazards and risks at all times, particularly during fieldwork situations where levels of risk may vary at any given time.

Where possible, non-simulated field work should be programmed into the learning period to take into account seasonal opportunities. Following field operations, learners will demonstrate simple maintenance and pre storage tasks to minimise degeneration of the machine and to ensure the machine is in a useable condition for subsequent operations.

The range of machinery covered should include electric vehicles and machines if appropriate.

In Outcome 1, learners must demonstrate knowledge and understandings of the construction and working principles of a selection of Land-based machines commonly used in their area of study and demonstrate knowledge of the work and performance parameters of such machines.

In Outcome 2, learners will demonstrate an ability to prepare the machine for field operations and ensure that the machine is matched and correctly connected to a suitable power unit. Machines are to be selected from the 'range/scope' list outlined in the unit content. It is essential that manufacturers' recommendations be followed to enable machines to be initially set to achieve given fieldwork criteria.

In Outcome 3, learners will need to explain safe operational procedures and carry out risk assessment prior to engaging in fieldwork. Suitable field procedures are to be demonstrated, regular checks to be made on machine performance and necessary adjustments made to both machine and power unit to meet given fieldwork criteria economically and efficiently.

In Outcome 4, following fieldwork operations, learners must carry out pre-storage maintenance, carry out an inspection to identify and subsequently rectify any faults. Wearing components will need to be assessed and replaced if wear limits are reached. Throughout the unit the emphasis will be on safe, legal practices, working to manufacturers' recommended procedures and attention to detail when recording information.

Depending on the Land-based area the learner is studying, formal lecture delivery may be generic to all areas but practical experiences and learning should be appropriate to the area of study.

## References

### Books

Balls, R. 1985. Horticultural Engineering Technology: Field Machinery. Hampshire: Palgrave Macmillan. ISBN 0333364341

Bell, B. 2008. *Farm Machinery*. Ipswich: Old Pond Publishing. ISBN 1903366682.

Culpin, C. 1992. *Farm Machinery* 12<sup>th</sup> ed. Sussex: Wiley Publishing. ISBN 063203159X

### Journals

Farmers Weekly

Amenity Machinery and Equipment

Profi International

### Websites

[www.hse.gov.uk](http://www.hse.gov.uk)

Health and Safety Executive

Manufacturer's websites

## Unit 317

# Understanding and Working with Land-based Repair Processes and Materials Technology

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to material and joining skills and knowledge in and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Know the structure and properties of materials
2. Know mechanical, non thermal and thermal joining processes
3. Be able to prepare materials for mechanical, non thermal and thermal joining processes
4. Be able to use mechanical, non thermal and thermal joining processes

### 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 Land-based service engineering NOS.

### 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 317

# Understanding and Working with Land-based Repair Processes and Materials Technology

## Outcome 1

Know the structure and properties of materials

### Assessment Criteria

The learner can:

1. Describe the **structure** and **properties** of **metals** used in land-based technology
2. Describe the structure and properties of **non-metal** materials used in land-based technology

### Unit content

#### Structure

Hardness, softness, strength

#### Properties

Brittleness, toughness, plasticity, malleability, conductivity, ductility, expansion, stability, yield point

#### Metals

Ferrous, non ferrous, alloy metals

#### Non metal

Thermo-set plastics, thermo setting plastics

## Unit 317

# Understanding and Working with Land-based Repair Processes and Materials Technology

## Outcome 2

Know mechanical, non thermal and thermal joining processes

### Assessment Criteria

The learner can:

1. Explain selected **mechanical, non thermal** and **thermal joining** processes for **metals**
2. Explain selected mechanical, non thermal and thermal joining processes for **non-metal** materials used in land based technology

### Unit content

#### Mechanical

Nuts, bolts, set screws, studs, rivets, keys, pins, captive fasteners, locking devices

#### Non thermal

Adhesives, fibreglass, crimping, soldering

#### Thermal joining

Brazing, Oxy- acetylene, Manual Metal Arc, Metal Inert gas

#### Metals

Ferrous, non ferrous, alloy metals

#### Non-metals

Thermo set plastics, thermo setting plastics



## Unit 317

# Understanding and Working with Land-based Repair Processes and Materials Technology

## Outcome 3

Be able to prepare materials for mechanical, non thermal and thermal joining processes

### Assessment Criteria

The learner can:

1. Safely **prepare** selected **metal** engineering materials for **joining**
2. **Safely** prepare selected **non-metal** engineering materials for joining

### Unit content

#### Prepare

Thermal cutting (plasma, oxy-acetylene, oxy-propane) sawing, shearing, grinding, filing, drilling, thread cutting, marking out, measuring, clamping, tacking

#### Metal

Ferrous, non ferrous, alloy metals

#### Safely

Risk assessment, safe practices, personal protective equipment, fume extraction, dusts, fumes, radiation, swarf, sparks, noise, spatter, hot metals, gas safety, codes of practice, industry codes, and relevant legislation

#### Joining

Thermal, non-thermal, mechanical

#### Non-metal

Thermo set plastics, thermo setting plastics

## Unit 317

# Understanding and Working with Land-based Repair Processes and Materials Technology

### Outcome 4

Be able to use mechanical, non thermal and thermal joining processes

#### Assessment Criteria

The learner can:

1. Safely **join metal** engineering materials to meet **given objectives**
2. Safely join **non-metal** engineering materials to meet given objectives

#### Unit content

##### Join

Fix together, thermal processes, non thermal process, and mechanical processes

##### Given objectives

Drawings, tolerances, repair, long term, short term, fit for purpose

##### Metal

Ferrous, non ferrous, alloy metals

##### Non-metal

Thermo set plastics, thermo setting plastics

## **Unit 317                      Understanding and Working with Land-based Repair Processes and Materials Technology**

### **Notes for guidance**

This unit is designed to provide the learner with a sound knowledge and the necessary skills to be able to describe the structure and properties of metals and non-metals used in land-based repair processes. The learner will be able describe mechanical, thermal and non-thermal joining processes, this will include the ability to be able to carry out preparation for joining and joining of metals and non-metals, .The teaching will need to cover a range of equipment appropriate to the learners background. It will also enable the learner to carry out appropriate risk assessments for the preparation and joining tasks.

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.

Delivery this can take the form of classroom based sessions, workshop practical sessions, in work evaluation and assessment of the joining techniques. The use of visiting speakers may also be considered.

The techniques chosen must be by agreement with the tutor should be of equal complexity to ensure fairness of assessment.

In Outcome 1 the learner will be able to describe the properties and structure of ferrous and non-ferrous metals, thermo set plastics and thermo setting plastics used in land-based repair processes.

In Outcome 2 the learner will be able to describe mechanical, non-thermal and thermal processes used in land-based repair.

In Outcome 3 the learner will be able to prepare materials for joining processes the materials and processes could be the same as those chosen in Outcome 2 but must show mechanical processes, thermal processes and non-thermal process for ferrous, non-ferrous and alloy metals. The learner will be able to carry out a risk assessment for all the processes identified and work within the requirements of the risk assessments, legislation, any relevant codes of practice and any standards recognised by industry.

In Outcome 4 the learner will be able to join materials these processes and materials could be the same as those in Outcome 3 but must show mechanical processes, thermal processes and non-thermal process for ferrous, non-ferrous and alloy metals. The learner will be able to carry out a risk assessment for all the processes identified and work within the requirements of the risk assessments, legislation, any relevant codes of practice and any standards recognised by industry.

## Unit 318

# Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)

**Level:** 3

**Credit value:** 10

### Unit aim

The aim of this unit is to provide the learner the understanding required for the maintenance and repair of cutting and lifting mechanisms of harvesting machinery and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

### Learning outcomes

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

1. Understand the principles of crop cutting and lifting in land based harvesting machinery
2. Be able to carry out 'preparation for work' procedures on crop cutting and lifting mechanisms in harvesting machinery
3. Be able to carry out maintenance, repair and 'out of season lay up' procedures on crop cutting and lifting mechanisms in harvesting machinery
4. Understand the 'control of' and specification of crop cutting and lifting mechanisms in harvesting 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

This unit is linked to the Land-based Service Engineering NOS.

### 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 318                      Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)**

**Outcome 1                      Understand the principles of crop cutting and lifting in land based harvesting machinery**

### **Assessment Criteria**

The learner can:

1. Explain the principles of crop cutting and lifting in **harvesting machinery**
2. Explain how **cutting** and **lifting mechanisms** accommodate varying **crops** and **crop conditions**

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, root crop harvesters, timber harvesters

### **Unit content**

#### **Cutting mechanisms**

Rotary, reciprocating and oscillating

#### **Lifting mechanisms**

Belts, augers, rollers, shares elevators, wheels

#### **Crops**

Cereal, green crops, root crops, timber

#### **Crop conditions**

Damp, dry, standing, laid, sparse, dense

## Unit 318

# Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)

## Outcome 2

Be able to carry out 'preparation for work' procedures on crop cutting and lifting mechanisms in harvesting machinery

### Assessment Criteria

The learner can:

1. Carry out adjustments to enable **crop cutting** and **lifting mechanisms** to give **optimal performance** in a range of crops and **crop conditions**

### Range

#### Harvesting machinery

Cereal, green crop harvesters, root crop harvesters, timber harvesters

### Unit content

#### Cutting mechanisms

Rotary, reciprocating and oscillating

#### Lifting mechanisms

Belts, augers, rollers, share elevators, wheels

#### Optimum performance

As set out in manufacturers guidance and advice, as required by further processing, storage or customer requirements, appropriate to crop, weather and ground conditions

#### Crop conditions

Damp, dry, standing, laid, sparse, dense

## **Unit 318                      Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)**

**Outcome 3**                      Be able to carry out maintenance, repair and ‘out of season lay up’ procedures on crop cutting and lifting mechanisms in harvesting machinery

### **Assessment Criteria**

The learner can:

1. Carry out **maintenance procedures** on crop **cutting and lifting mechanisms**
2. Carry out **procedures** to identify and **rectify faults** on crop cutting and lifting mechanisms
3. Carry out **‘out of season lay up’** procedures to crop cutting and lifting mechanisms

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, root crop harvesters, timber harvesters

### **Unit content**

#### **Cutting mechanisms**

Rotary, reciprocating and oscillating

#### **Lifting mechanisms**

Belts, augers, rollers, shares elevators, wheels

#### **Maintenance procedures**

As specified in manufacturers guidance, workshop manuals, operator manuals  
Maintenance can be daily, short term or long term

#### **Procedures**

As specified by machine manufacturers

#### **Faults**

Major, minor, harvesting

#### **Rectify**

Carry out the necessary procedures to enable the machine to operate correctly

#### **Out of season lay up**

The processes required to ensure that the machine is left in a safe and suitable condition to be stored for the out of season period: cleaning and servicing, corrosion prevention, protection from weather, protection from vermin

## Unit 318

# Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)

## Outcome 4

Understand the 'control of' and specification of crop cutting and lifting mechanisms in harvesting machinery

### Assessment Criteria

The learner can:

1. Explain the operator **control procedures** of crop cutting and lifting mechanisms
2. Explain the **specification** data of crop cutting and lifting mechanisms

### Range

#### Harvesting machinery

Cereal, green crop harvesters, root crop harvesters, timber harvesters

### Unit content

#### Control procedures

Procedures available to the operator to influence the performance of the cutting and lifting mechanism

#### Specification

As laid down the machine manufacturer in operator's manuals, workshop manuals and technical bulletins



# **Unit 318                      Understanding and Servicing Land-based Harvesting Machinery (Cutting and Lifting)**

## **Notes for guidance**

This unit is designed to provide the learner with a sound understanding and the necessary skills to be able to prepare the machines for work and carry out maintenance, repair and out of season lay up on machines appropriate to their work context.

Throughout the unit the emphasis must be on safe working practices. The learner will be expected to work with 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 need to be aware of the need to safeguard 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.

Delivery could take the form of classroom based sessions, workshop practical sessions, work placement evaluation and assessment of the systems performance. The use of visiting speakers may also be considered to assist with the delivery.

All learners will be expected to use machines of similar complexity to allow fairness of assessment.

For Outcome 1 the learner will need to explain the principles of crop cutting and lifting for harvesting machines. The learner will also need to explain how the cutting and lifting mechanisms chosen accommodate varying crops and crop conditions.

For Outcome 2 learners will need to carry out the adjustments necessary for preparing the cutting and lifting mechanisms for work to give optimal performance for different crops and crop conditions, different cutting types and lifting mechanisms. The optimal performance must give consideration to the areas identified in the unit content.

For Outcome 3 learners will need to carry out maintenance and repair procedures for different cutting and lifting mechanisms. The procedures followed will be those required by the crop, soil, weather conditions or as prescribed by the equipment manufacturer. They will also need to be able to identify and explain how to rectify faults in the systems.

In addition learners will need to be able to carry out the required out of season lay up procedures for different systems. This will include cleaning and servicing, ensuring that the systems are stored in such a way as to prevent deterioration, corrosion and damage by weather and other external forces, e.g. vermin.

For Outcome 4 learners will need to be able to explain the operation control procedures for different types of cutting and lifting mechanisms. This will include settings as set out by the manufacturer, adjustments made in the field to accommodate crop, soil and weather conditions. Learners will also need to be able to explain the use of manufacturers' specification and data used to achieve the required results for crop cutting and lifting mechanisms. This will require the use of operators manuals

and other manufacturers information, the requirements of the customer and any other requirements there may be for further processes after the crop has been harvested.

The use of the machines as identified in Outcome 1 for all the Outcomes should be seen as acceptable and good practice.

## References

### Books

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

Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X

Manufacturers publications and manuals

### Journals

Farmers Guardian

Profi International

Farmers Weekly

### Websites

[www.bagma.com](http://www.bagma.com)

[www.defra.gov.uk](http://www.defra.gov.uk)

[www.wales.gov.uk](http://www.wales.gov.uk)

[www.scotland.gov.uk](http://www.scotland.gov.uk)

[www.dardni.gov.uk](http://www.dardni.gov.uk)

[www.hse.gov.uk](http://www.hse.gov.uk)

[www.howstuffworks.com](http://www.howstuffworks.com)

[www.iagre.org](http://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 319

# Understanding and Servicing Land-based Harvesting Machinery (Processing)

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of crop processing in land-based harvest machinery, the control of and specification of crop processing mechanisms in harvesting machinery and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

### Learning outcomes

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

1. Understand the principles of crop processing in land-based harvesting machinery
2. Be able to carry out 'preparation for work' procedures on crop processing mechanisms in harvesting machinery
3. Be able to carry out maintenance, repair and 'out of season lay up' procedures on crop processing mechanisms in harvesting machinery
4. Understand the control of and specification of crop processing mechanisms in harvesting 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

This unit is linked to the National Occupational Standard LEO18 Service and Repair Land-based Harvesting and Processing 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 319                      Understanding and Servicing Land-based Harvesting Machinery (Processing)**

Outcome 1                      Understand the principles of crop processing in land-based harvesting machinery

### **Assessment Criteria**

The learner can:

1. Explain the principles of crop processing in harvesting machinery
2. Explain how **processing mechanisms** accommodate varying crops and crop conditions

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, balers, root crop harvesters and timber harvesters

### **Unit content**

#### **Processing mechanisms**

Threshing, cleaning, crimping, separating, conveying, tying, wrapping, accommodation for crops and crop conditions

## **Unit 319                      Understanding and Servicing Land-based Harvesting Machinery (Processing)**

**Outcome 2**                      Be able to carry out ‘preparation for work’ procedures on crop processing mechanisms in harvesting machinery

### **Assessment Criteria**

The learner can:

1. Carry out **adjustments** to enable **crop processing** mechanisms to give **optimal performance** in a range of crops and **crop conditions**

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, balers, root crop harvesters and timber harvesters, grading equipment

#### **Crop processing**

Threshing, cleaning, crimping, separating, conveying, tying, wrapping

#### **Crops**

Cereals and other combinable crops, root crops, green and forage crops, timber

### **Unit content**

#### **Adjustments**

Forward Speed, drum speed, clearances, height, length, density, size, as required by machine manufacturer, crop conditions, soil conditions, weather conditions

#### **Optimal performance**

Maximising crop harvested, crop quality and condition, crop suitability for storage and further processes, meeting customer requirements, minimising crop loss, crop damage, contamination (soil, weed seeds, foreign bodies)

#### **Crop conditions**

Damp, dry, standing, laid, sparse, dense

## **Unit 319                      Understanding and Servicing Land-based Harvesting Machinery (Processing)**

**Outcome 3**                      Be able to carry out maintenance, repair and ‘out of season lay up’ procedures on crop processing mechanisms in harvesting machinery

### **Assessment Criteria**

The learner can:

1. Carry out **maintenance procedures** on crop processing mechanisms
2. Carry out procedures to identify and rectify faults on crop processing mechanisms
3. Carry out **‘out of season lay up’ procedures** to crop processing mechanisms

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, balers, root crop harvesters and timber harvesters, grading equipment

#### **Crop processing**

Threshing, cleaning, crimping, separating, conveying, tying and wrapping

### **Unit content**

#### **Maintenance procedures**

As specified in manufacturer’s guidance, Workshop Manuals, Operator manuals, the maintenance can be daily short term, or long term.

#### **Out of season layup procedures**

Processes required ensuring that the machine is left in a safe and suitable condition to be stored for the out of season period: cleaning and servicing, corrosion prevention, protection from weather, protection from vermin

## **Unit 319                      Understanding and Servicing Land-based Harvesting Machinery (Processing)**

**Outcome 4                      Understand the control of and specification of crop processing mechanisms in harvesting machinery**

### **Assessment Criteria**

The learner can:

1. Explain the operator control procedures of **crop processing** mechanisms
2. Explain the **specification** data of crop processing mechanisms

### **Range**

#### **Harvesting machinery**

Cereal, green crop harvesters, balers, root crop harvesters and timber harvesters

### **Unit content**

#### **Crop processing**

Threshing, cleaning, crimping, separating, conveying, tying and wrapping

#### **Specification**

As laid down the machine manufacturer in operator's manuals, workshop manuals and technical bulletins

## **Unit 319                      Understanding and Servicing Land-based Harvesting Machinery (Processing)**

### **Notes for guidance**

This unit is designed to provide the learner with a sound understanding and the necessary skills to be able to prepare harvesting machinery for work and carry out maintenance, repair and out of season layup on machines appropriate to their 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, 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.

Delivery could take the form of classroom based sessions, workshop practical sessions, visits to see a range of harvesting machinery and equipment, and links to work experience activity. The use of visiting speakers may also be considered.

In Outcome 1 the learner will need to gain an understanding of the principles of crop processing, and how processing mechanisms accommodate different crops and conditions. It is likely that delivery of this outcome is largely classroom based, supplemented by visits to see a range of crop processing machinery.

In Outcome 2, delivery is likely to be practically based, including demonstrations and supervised practical activities. Learners will need the opportunity to practice carrying out the adjustments necessary for preparing the processing mechanisms for work to give optimal performance. Delivery should also include consideration of how optimal performance might be defined.

In Outcome 3 learners will gain the skills to carry out maintenance and repair procedures for different types of processing mechanisms, and will need sufficient supervised practice to develop their skills. The procedures followed will be those as required by the crop, soil or weather conditions as appropriate, or as prescribe by the equipment manufacturer. Learners will also learn how to identify and explain how to rectify faults in the mechanism. In addition learners will develop the skills to carry out the required out of season and layup procedures for one processing mechanism, including the cleaning and servicing required, and ensuring that the mechanism is stored in such a way that it does not deteriorate during the layup period. Consideration should be given to corrosion prevention, damage by weather and other external forces and to vermin damage.

In Outcome 4 learners will gain an understanding of the operator control procedures for different types of processing mechanisms, including settings as set out by the machine manufacturer and adjustments made in the field to accommodate crop, soil, and weather conditions. Delivery also needs to include the use of manufacturers' specifications and data used to achieve the required results for the processing mechanism. This will require the use of operator manuals and other manufacturers information, the requirements of the customer and any requirements there may be for further processes, for example storage of the crop. Delivery is likely to include classroom based activities,



including reviewing of specification data for a range of machines, supplemented by visits and linked to practical delivery for Outcomes 2 and 3.

## References

### Books

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<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 320

# Working with Land-based Construction Plant Materials Handling Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in the maintenance and repair of materials handling equipment and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

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

### 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 Land based service engineering NOS.

### 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 320

# Working with Land-based Construction Plant Materials Handling Equipment

### Outcome 1

Understand the function and specification of construction plant materials handling equipment

#### Assessment Criteria

The learner can:

1. Explain the function of construction plant **materials handling** equipment
2. Explain the **specifications** of construction plant materials handling equipment
3. Outline the layout of key **working components** and **assemblies** of given specialist construction plant materials handling equipment

#### Unit content

##### Materials handling

Telehandlers, cranes, mobile, static, lifts, fork lift trucks, diggers, dumpers, lorries, trailers, hoists Hiab

##### Specification

Tracked, wheeled, steel tracks, rubber tracks, engine horsepower, hydraulic capacity, tear out, lift capacity, reach height, digging depth, operator controls, operator comfort, weight, overall dimensions

##### Working components

Engines, hydraulics, electric motors, cables, chains, shafts, wheels, tracks, tyres, transmissions

##### Assemblies

Cable drums, braking systems, drive assemblies, fail safe, steering, control

## Unit 320

## Working with Land-based Construction Plant Materials Handling Equipment

### Outcome 2

Understand the principles of operation of construction plant materials handling equipment

#### Assessment Criteria

The learner can:

1. Explain principles of **lifting mechanisms** of materials handling equipment
2. Explain principles of **handling** mechanisms of materials handling equipment

#### Unit content

##### Lifting mechanisms

Hydraulic, cable, chain, mechanical, hydrostatic, levers, linkages, drive systems, engine systems

##### Handling

Grip, tilt, rotate, lift, traverse

## Unit 320

## Working with Land-based Construction Plant Materials Handling Equipment

### Outcome 3

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

#### Assessment Criteria

The learner can:

1. Carry out **maintenance** to lifting and handling mechanisms of construction plant materials handling equipment
2. Carry out an appropriate **risk assessment** for given procedures

#### Unit content

##### Maintenance

Long term, short term, required by manufacturers data, hours worked, company policy, preventative

##### Risk assessment

The assessment of the associated risks in carrying out the maintenance procedures

## Unit 320

## Working with Land-based Construction Plant Materials Handling Equipment

### Outcome 4

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

#### Assessment Criteria

The learner can:

1. Carry out (using manufacturers recommendations) **fault diagnosis** and **repair** to lifting and handling mechanisms of materials handling equipment
2. Describe fault diagnosis and repairs carried out

#### Unit content

##### Fault

Continuous, intermittent

##### Diagnosis

Identification of faults using recognised test procedures and equipment, as required by the machine manufacturer

##### Repair

Short term, long term, remedial, preventative, carry out procedures which will rectify faults as diagnosed and enable the machine to continue working

## Unit 320

# Working with Land-based Construction Plant Materials Handling Equipment

## Notes for guidance

This unit is designed to provide the learner with a sound knowledge and the necessary skills to be able to explain, service and maintenance of materials handling equipment. The teaching will need to cover a range of equipment appropriate to the learners background. It will also enable the learner to carry out appropriate risk assessments for the maintenance tasks. The learner will be able to carry out fault diagnosis and repair procedures on a range of materials handling equipment.

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, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learners 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.

Delivery of the unit can take the form of classroom based sessions, workshop practical sessions, in work evaluation and assessment of the systems performance. The use of visiting speakers may also be considered.

The equipment chosen by agreement with the tutor should be of equal complexity to ensure fairness of assessment.

In Outcome 1 the learner will be able to explain the function materials handling equipment. This will include how the equipment carries out the tasks to meet given objectives. The learner will be able to explain the specifications of comparable types of materials handling equipment, for an identified task. The learner will be able to outline the layout of the key working components and specialist assemblies for the equipment chosen.

In Outcome 2 the learner will be able to explain the principles of the lifting and handling mechanisms identified in Outcome 1. Therefore these outcomes can be delivered in conjunction with each other.

In Outcome 3 the learner will be able to carry out suitable risk assessment for any maintenance task undertaken. The learner will be able to carry out the maintenance required for the identified materials handling equipment in line with recognised service schedules.

In Outcome 4 the learner will be able to carry out fault diagnosis describe the faults and any repairs carried out or recommendations for repair for intermittent faults and continuous faults, on the identified equipment. Repairs carried out should cover short and long term and the candidate should be able to describe what remedial action is taken and the type of maintenance and repair that may be carried out to prevent further or future break downs.

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Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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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### Journals

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Farmers Weekly

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<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
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<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers



## Unit 321

# Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in the maintenance and repair of ground engaging and consolidation equipment and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the function and specification of ground engaging and consolidation construction plant machinery
2. Understand the principles of operation of ground engaging and consolidation machinery mechanisms
3. Be able to carry out maintenance to ground engaging and consolidation equipment
4. Be able to carry out fault diagnosis and repair on ground engaging and consolidation 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 National Occupational Standards for Land-based Engineering.

### 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 321

### Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment

#### Outcome 1

Understand the function and specification of ground engaging and consolidation construction plant machinery

#### Assessment Criteria

The learner can:

1. Explain the function of construction plant **ground engaging** machinery
2. Explain the specifications of construction plant **ground engaging** machinery
3. **Discuss** the use of selected ground engaging and **consolidation equipment** in a given situation

#### Unit content

##### Ground engaging

any equipment that is used to dig into or scrape the ground, diggers 360 degrees, 180 degrees, trenchers, dozers, bull, angle, scrapers, levellers

##### Discuss

Reasons for the choices made for the selection of equipment to be used in a given situation

##### Consolidation equipment

Pedestrian controlled, Ride on, any equipment used to consolidate soil and other surfaces, compaction tractors, rollers, compaction plates, whaker plates, vibration rollers.

## Unit 321

# Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment

## Outcome 2

Understand the principles of operation of ground engaging and consolidation machinery mechanisms

### Assessment Criteria

The learner can:

1. **Explain principles of operation** of ground engaging and consolidation **mechanisms** of construction plant machinery

### Unit content

#### Explain

Written, Verbal

#### Operation

The way in which the machinery achieves its goal, digging, rolling, vibration, pressure, force, leverage

#### Mechanisms

Mechanical, hydraulic, hydrostatic, levers, linkages, drive systems, engine systems

## Unit 321

# Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment

## Outcome 3

Be able to carry out maintenance to ground engaging and consolidation equipment

### Assessment Criteria

The learner can:

1. Carry out a **risk assessment** relevant to **scheduled maintenance** of ground engaging and consolidation mechanisms of construction plant machinery
2. Carry out **scheduled maintenance** to ground engaging and consolidation mechanisms of construction plant machinery

### Unit content

#### Risk assessment

The assessment of the associated risks in carrying out the maintenance procedures

#### Scheduled maintenance

Long term, short term, required by manufacturer's data, hours worked, company policy, preventative

## Unit 321

### Working with Land-based Construction Plant Ground Engaging and Consolidation Equipment

#### Outcome 4

Be able to carry out fault diagnosis and repair on ground engaging and consolidation equipment

#### Assessment Criteria

The learner can:

1. Carry out (using manufacturers recommendations) **fault diagnosis** and **repair** on ground engaging and consolidation mechanisms of construction plant machinery
2. **Describe** fault diagnosis and repair carried out

#### Unit content

##### Fault

Continuous, intermittent

##### Diagnosis

Identification of faults using recognised test procedures and equipment, as required by the machine manufacturer

##### Repair

Short term, long term, remedial, preventative, carry out procedures which will rectify faults as diagnosed and enable the machine to continue working

##### Describe

Written, verbal

## Notes for guidance

This unit is designed to provide the learner with a sound knowledge and the necessary skills to be able to explain, service and maintenance of soil engaging and consolidation equipment. The teaching will need to cover a range of equipment appropriate to the learner's background. It will also enable the learner to carry out appropriate risk assessments for the maintenance tasks. The learner will be able to carry out fault diagnosis and repair procedures on a range of soil engaging and consolidation equipment.

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.

Delivery of this unit can take the form of classroom based sessions, workshop practical sessions, in work evaluation and assessment of the systems performance. The use of visiting speakers may also be considered.

Outcome 1 and 2 the learner will be able to explain the function, specification and operating principles of engaging and consolidation equipment. The delivery of these outcomes will mainly be classroom based but could benefit from demonstrations of equipment and possibly talks from or visits to machinery suppliers.

Outcomes 3 and 4 are practical based and the delivery will be in the workshop and practical demonstrations. The learner will be required to carry out a risk assessment on the maintenance tasks of plant ground engaging and consolidation equipment. Learners will need to be given the time to practice diagnostic tests and repairs on the machinery

## References

### Books

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

Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X

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<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 322

# Working with Land-based Diesel Fuel Injection Systems

**Level:** 3

**Credit value:** 10

### Unit aim

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

### Learning outcomes

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

1. Understand diesel fuel types, systems and components used in land based vehicles
2. Know the components that are employed in land based vehicle diesel fuel injection systems
3. Be able to carry out routine service, testing and repairs to diesel fuel injection systems
4. Understand methods by which engine management systems control engine performance and emissions

### 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 Land-based service engineering NOS.

### 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 322                      Working with Land-based Diesel Fuel Injection Systems**

**Outcome 1                      Understand diesel fuel types, systems and components used in land based vehicles**

### **Assessment Criteria**

The learner can:

1. Explain the layout of **diesel fuel injection systems** used in land-based vehicles
2. Explain how commonly used **cold starting aids function**
3. Explain the importance of **filtration** of diesel fuel and air

### **Unit content**

#### **Diesel fuel injection systems**

Direct, indirect, mechanical, electronic injection

#### **Cold starting aids**

Glow plugs, grid heater, Thermostat, donkey engine, block heaters

#### **Filtration**

Size (micron), water, centrifugal, fibre (paper, fibreglass etc), plate, foam, cotton gauze, oil bath

## Unit 322

## Working with Land-based Diesel Fuel Injection Systems

### Outcome 2

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

#### Assessment Criteria

The learner can:

1. Describe the working principles of **components** used in **diesel fuel injection systems**
2. Describe the working principle of a mechanical fuel injector
3. Describe the working principles of selected **mechanical fuel injection pumps**

#### Unit content

##### Components

Tank, lift pump, filter, injection pump, injectors, injector pipes, fuel return line

##### Diesel fuel injection systems

Direct, indirect, mechanical, electronic injection

##### Mechanical fuel injection pumps

In line, rotary, individual

## **Unit 322**                    **Working with Land-based Diesel Fuel Injection Systems**

Outcome 3                    Be able to carry out routine service, testing and repairs to diesel fuel injection systems

### **Assessment Criteria**

The learner can:

1. Carry out routine service and testing of **diesel fuel injection systems**
2. Produce a **report** to outline the serviceability of a given diesel fuel injection system
3. Carry out **non-scheduled** repairs and maintenance to a diesel fuel injection system

### **Unit content**

#### **Diesel fuel injection systems**

Direct, indirect, mechanical, electronic injection

#### **Report**

Comparative table, written report, verbal presentation

#### **Non-scheduled**

Breakdowns, poor performance, excessive emissions

## Unit 322

# Working with Land-based Diesel Fuel Injection Systems

### Outcome 4

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

#### Assessment Criteria

The learner can:

1. Explain what factors ensure **diesel fuel** is used efficiently to comply with current **emissions regulations**
2. Compare different types of **diesel fuel injectors** and the effect they have on fuel combustion
3. Justify the development of **electronic control of injection systems** and how they are integrated into electronic engine management systems

#### Unit content

##### Diesel fuel

White diesel (EN590), Rebated Heavy Oil (red BS 2869)

##### Emissions regulations

European Stage emission ratings and American Tier ratings, date of implication, Particles, Nitrous Oxides, carbon monoxides, hydro carbons, Exhaust Gas Recirculation (EGR)/Selective Catalytic Reduction (SCR) systems

##### Diesel fuel injectors

Mechanical, electronic

##### Electronic control of injection systems / electronic engine management systems

Electronic control unit, electronic controlled mechanical pump (e.g. Bosch VE Pump), piezoelectric injectors, engine sensors (temp, pressure, speed throttle potentiometer) EGR / SCR systems

## Unit 322 Working with Land-based Diesel Fuel Injection Systems

### Notes for guidance

This unit is designed to provide learners with knowledge and skills required to service, diagnose faults and repair faults on all diesel systems found on land based vehicles. Until recently development of land based diesel systems has been relatively minor, but with the introduction of emission controls from the EU, USA and other developed countries has seen the introduction of electronic control of mechanical fuel injection systems and full electronic control. The learner must be aware of the dangers involved with diesel systems, especially of those involved in the new high pressure injection systems. At all times when practical tasks are carried out or assessed, an emphasis must be put on safe working practises and current legislation. Where maintenance or repairs are undertaken, these must be in line with manufacturers' specifications.

In Outcome 1 the learner gains knowledge of the function and operation of land based fuel injection systems. The layout of all injection systems must be explained including differing cold starting aids, and filtration systems. It will be necessary to access to a range of modern equipment for these comparisons and evaluations to be made. Delivery is likely to include classroom based activities, supported by supervised workshop practice.

In Outcome 2, the learner gains knowledge to describe the working principles of the components used in modern land based vehicles, including mechanical fuel injection pumps and injectors. Delivery is likely to include a mix of classroom and workshop sessions.

In Outcome 3, the learner will gain the skills to carry out routine and non scheduled services on land based vehicle diesel fuel injection systems, with an understanding of the need for cleanliness is paramount. Emphasis will be on safe and efficient working practices throughout. Delivery is likely to be largely practical, including demonstrations, supervised practical's and links to appropriate work experience activity.

In Outcome 4 the learner will gain an understanding of the factors effecting the efficiency of diesel fuel systems, including how differing types of fuel injectors effect combustion. Recently new emission laws have brought about new developments on diesel fuel injection, and as such an understanding of what the restricted emissions (nitrous oxides, particulate matter, hydro carbons, and carbon mon/dioxide) is needed. Because of these emission regulations the introduction of electronic controls, exhaust gas recirculation and post combustion treatments of exhaust gasses have been introduced, and the learner must understand how these are integrated into modern fuel injection systems in order to justify why they have been introduced. The learner must also be aware of any extra hazards that are present with these new injection systems (high fuel pressure) and any precautions necessary.

The majority of these Outcomes can be lesson taught though relevant cutaway models, and animations showing working components can assist learning. These lessons can be backed up by practical demonstrations. It is essential that both mechanical and electrical injection systems are covered. To assist with the explaining the control of electronic fuel injection, it may be advisable to get a local dealer to supply a service technician to demonstrate how electronic control of fuel injection can be observed by using a laptop.

## References

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- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
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## Unit 323

# Undertaking Land-based Technology Engineering Drawing

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in the creation of three-dimensional objects accurately through the drawing of two-dimensional views. They will consider orthographic projection, the design process and methods of presenting engineering design ideas and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Be able to produce and interpret engineering drawings in isometric and orthographic projection
2. Be able to produce geometrical constructions
3. Understand the overall concept of the design process and the role of the engineering drawing office
4. Be able to produce presentation drawings

### 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 Land-based Engineering National Occupational Standards.

### 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 323                      Undertaking Land-based Technology Engineering Drawing**

**Outcome 1                      Be able to produce and interpret engineering drawings in isometric and orthographic projection**

### **Assessment Criteria**

The learner can:

1. Produce and interpret **engineering working drawings** in **isometric** and **orthographic** projection to meet given objectives

### **Unit content**

#### **Engineering working drawings**

Drawing representing a machine or component normally drawn in first and third angle projections

#### **Isometric projection**

Isometric drawing is another way of presenting designs/drawings in three dimensions.

#### **Orthographic projection**

A method by drawing a, 3D object in 2D It is from different directions, usually a front, side and plan view are drawn.



## Unit 323

# Undertaking Land-based Technology Engineering Drawing

## Outcome 2

Be able to produce geometrical constructions

### Assessment Criteria

The learner can:

1. Produce **geometrical constructions** from working drawings

### Unit content

#### Geometrical constructions

Drawing precise drawings using a compass and a straight edge

## Unit 323

## Undertaking Land-based Technology Engineering Drawing

### Outcome 3

Understand the overall concept of the design process and the role of the engineering drawing office

#### Assessment Criteria

The learner can:

1. Explain the **design process**
2. Discuss the role of the engineering drawing office

#### Unit content

##### Design Process

The process involved in taking a design brief, designing and developing the end product, producing and testing prototypes. Presenting final design and planning production

## Unit 323

## Undertaking Land-based Technology Engineering Drawing

### Outcome 4

Be able to produce presentation drawings

#### Assessment Criteria

The learner can:

1. Produce **manual presentation drawings** of a **selected product or design** to meet given objectives

#### Range

Selected product or design

#### Unit content

##### Manual presentation drawings

Draw in isometric and orthographic projection selected product or designs

# Unit 323                      Undertaking Land-based Technology Engineering Drawing

## Notes for guidance

This unit introduces the learner to the skills and knowledge in the creation of three-dimensional objects accurately through the drawing of two-dimensional views. Learners will need access to a suitably equipped room containing engineering drawing boards, and equipment and also have access to a copy of the manual of British Standards in engineering drawing.

Outcomes 1, 2 and 3 can be delivered jointly starting by looking at different methods of drawings are drawn, proceeding through to producing some drawings. For this a selection of parts and objects, must be available for the learner to draw.

Outcome 3 can be delivered by lecturers, or by a visit to a factory or design studio to see the various stages of one or more product.

### References

#### Books

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| <a href="http://www.defra.gov.uk">www.defra.gov.uk</a>           | Department for Environment, Food and Rural Affairs    |
| <a href="http://www.howstuffworks.com">www.howstuffworks.com</a> | How Stuff Works                                       |
| <a href="http://www.hse.gov.uk">www.hse.gov.uk</a>               | Health and Safety Executive                           |
| <a href="http://www.iagre.org">www.iagre.org</a>                 | Institution of Agricultural Engineers                 |

## Unit 324

# Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge involved in the construction, operation and servicing of machines designed to prepare seedbeds and plant seeds and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the operation and function of land-based cultivation and planting machines
2. Be able to carry out routine service and non routine maintenance to land-based cultivation and planting machines
3. Be able to carry out inspection and overhaul procedures on land-based cultivation and planting machines
4. Understand how machines produce different seedbeds to cater for different crops and planting 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 Land-based Service Engineering NOS.

### 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 324                      Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)**

**Outcome 1**                      Understand the operation and function of land-based cultivation and planting machines

### **Assessment Criteria**

The learner can:

1. Compare the **function** of a given range of **cultivation and planting machines**
2. Explain the **operating principles** of a range of cultivation and planting machines
3. Evaluate a range of available machines which have similar **functions** but use different operating principles

### **Unit content**

#### **Function**

What the machine does (cut chop smash squash, spread, and sow) and how it does it, (tines discs, coulter types, broadcasters metering units), operational width

#### **Cultivation and planting machines**

Cultivation machinery: Powered, non powered cultivation equipment including primary and secondary (subsoilers and mole ploughs, mouldboard ploughs, disc harrows, rigid tine cultivators, spring tine cultivators, seed harrows, arable rolls and presses (single and double), powered cultivators e.g. vertical rotor harrows, horizontal rotor harrows)

Planting machinery: seed drills, combination drills, precision planters (mechanical and pneumatic), transplanters

#### **Operating principles**

Tine angle, tine type depth control

Disc shape, size, function and angle, depth control

Consolidation, roll, wheel, position, weight transfer, ground following

Mouldboard size shape, skimmers, depth control

#### **Functions**

Drilling, planting, cultivation, consolidation or a combination of all/some of these

## **Unit 324                      Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)**

**Outcome 2**                      Be able to carry out routine service and non routine maintenance to land-based cultivation and planting machines

### **Assessment Criteria**

The learner can:

1. Carry out **routine service** tasks to a given **range of machines** in accordance with manufacturers schedules
2. Carry out **non routine maintenance** tasks to a given range of machines which are not outlined in manufacturers service schedules
3. Discuss the **consequences** on the performance of cultivation and planting machines that have not been subjected to adequate service and maintenance

### **Unit content**

#### **Routine service**

Daily, weekly seasonal services as laid down in the machines operator's manual

#### **Range of machinery**

Powered, non powered cultivation equipment, drilling and planting machinery

#### **Non routine maintenance**

Breakdowns, malfunctions and upgrade work

#### **Consequences**

Component failure, unsatisfactory operation, reduced output, downtime

## **Unit 324                      Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)**

**Outcome 3**                      Be able to carry out inspection and overhaul procedures on land-based cultivation and planting machines

### **Assessment Criteria**

The learner can:

1. Produce **condition reports** on a given **range of cultivation and planting machines**
2. Carry out **distortion and alignment** checks on a given range of cultivation and planting machines
3. Carry out **overhaul procedures** to a given range of cultivation and planting machines

### **Unit content**

#### **Condition report**

Verbal, visual or written report on state of repair of machinery

#### **Range of cultivation and planting machines**

Powered, non powered cultivation equipment, drilling and planting machinery

#### **Distortion and alignment**

Visual, measuring

#### **Overhaul procedures**

Lubrication, routine service, replacing wearing parts



## **Unit 324                      Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)**

**Outcome 4**                      Understand how machines produce different seedbeds to cater for different crops and planting techniques

### **Assessment Criteria**

The learner can:

1. **Prepare** a given **range of cultivation and planting machines** for work
2. **Operate and adjust** a given range of machines to achieve given **objectives**
3. Evaluate the **quality of work and work rates** of a given range of cultivation and planting machines when subjected to different settings and conditions

### **Unit content**

#### **Prepare**

Set up as per operator's instruction book

#### **Range of cultivation and planting machines**

Powered, non powered cultivation equipment, drilling and planting machinery

#### **Operate and adjust**

Use the machinery as per the operator's instruction manual, and adjust to gain satisfactory results

#### **Objectives**

Cultivation objectives: to prepare the soil at the required depth into the required size to meet the needs of the next operation

Planting objectives: to place the seed at the correct depth, spacing and with correct soil coverage to give germination

#### **Quality of work and work rates**

Cultivation: depth, finish, clod size, speed, width of machine.

Planting: consistency of seed placement, seed spacing, seed coverage, width of planting, speed of planting

## **Unit 324                      Understanding and Servicing Land-based Machines (Cultivation and Planting Equipment)**

### **Notes for guidance**

This unit allows the learner to understand the function and operation of cultivation and planting equipment, be aware of the need for, and carry out routine inspection, service and overhaul. The Learner will also learn how to set up, operate and evaluate a full range of planting and cultivation equipment.

For all the outcomes a full range of machinery must be available to the learner to include: conventional, combination and pneumatic drills, precision planting machines of relevant types, sub-soilers and mole ploughs, mouldboard ploughs, disc harrows, rigid tine cultivators, spring tine cultivators, seed harrows, arable rolls and presses and powered cultivators (power harrows, rotavators.) Attention should be brought to the multi functional machinery that combines functions of two or more of these machines (e.g. Simba Solo, Vaderstad Rapid A drill/Topdown cultivator, Horsch Sprinter drills).

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. 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.

Outcome 1 allows the learner to compare a range of cultivation and planting machinery, from a full range of machinery. The learner must learn operating principles of the equipment, and be aware of different machines that are capable of the producing the same or very similar results (e.g. discs and drags). This is a mainly classroom base unit, but examples drill coulters, metering units, cultivation tines discs and points must be available for demonstration and discussion.

Outcome 2 allows the learner to carry out routine and non routine servicing, in order to carry this out a range of replacement and service parts must be available. The learner must also discuss either written or verbally with the tutor, the consequences of poor service and maintenance, in the performance and financial terms. This unit is workshop based and requires well planned practical's to ensure the learner has full understanding of the subject.

Outcome 3 looks at inspection and checks (for wear, distortion and damage). This unit can be run in conjunction with Outcome 2 as the inspection of machinery and servicing tend to go hand in hand.

Outcome 4 looks at the operation and in work adjustment of planting and cultivation equipment. A range of ground conditions and types should be used. Guidance should be given to the learner to help with machine adjustment, to meet the operation requirements. If certain machines are not available, a visit to a local or national demonstration such as Tillage may be appropriate, or a local farm with the relevant machine.

Outcomes 2, 3 and 4 are mainly workshop practical based. Throughout the unit the emphasis is on acceptable health and safety procedures and safe working practices

## References

### Books

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- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers publications and manuals

### Journals

- Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

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| <a href="http://www.defra.gov.uk">www.defra.gov.uk</a>           | Dept for Environment, Food and Rural Affairs                   |
| <a href="http://www.wales.gov.uk">www.wales.gov.uk</a>           | Welsh Assembly Government                                      |
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| <a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>         | Department of Agriculture and Rural Affairs (Northern Ireland) |
| <a href="http://www.hse.gov.uk">www.hse.gov.uk</a>               | Health and Safety Executive                                    |
| <a href="http://www.howstuffworks.com">www.howstuffworks.com</a> | How Stuff Works  |
| <a href="http://www.iagre.org">www.iagre.org</a>                 | Institution of Agricultural Engineers                          |

## Unit 325

# Working with Land-based Machinery (Application Equipment)

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge required for working with land-based application equipment and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the function of land based application equipment
2. Be able to prepare land based application equipment for field use
3. Be able to test, overhaul and repair land based application machines
4. Be able to operate land based application 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 Land-based Service Engineering NOS.

### 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 325

## Working with Land-based Machinery (Application Equipment)

### Outcome 1

Understand the function of land based application equipment

#### Assessment Criteria

The learner can:

1. Explain the function of a given range of land-based **application machines**
2. Explain the **operating principles** of a given range of land-based application machines
3. Compare the operating principles of application machines designed for similar purpose but use different **engineering solutions**

#### Range

##### Application machines

Crop Sprayers, fertilizer spreaders, slug pellet applicators, seed drills, solid and liquid manure spreaders, root crop planting equipment, planters and transplanters, irrigation equipment

#### Unit content

##### Operating principles

The principles by which the identified application equipment achieves the required goal including: feed mechanisms, control mechanisms, liquid flow, air flow, application rates, forward speed, pressure, depth control, height control flow rates

##### Engineering solutions

The different mechanisms used by application equipment to achieve the required goal to include: fluid pressure, vacuum, belts, chains, wheels, rollers, discs, tines, flow rates

## Unit 325

## Working with Land-based Machinery (Application Equipment)

### Outcome 2

Be able to prepare land based application equipment for field use

#### Assessment Criteria

The learner can:

1. **Prepare** given application machines for field operations
2. Carry out **routine service tasks** according to manufacturers instructions
3. **Report** on the **condition** of given land based application machines

#### Range

##### Application machines

Crop Sprayers, fertilizer spreaders, slug pellet applicators, seed drills, solid and liquid manure spreaders, root crop planting equipment, planters and transplanters, irrigation equipment

#### Unit content

##### Prepare

Carryout the necessary tasks to make the application equipment ready for work including: attachment, controls, initial settings, calibration, speed checks

##### Routine service tasks

Required to ensure the equipment is fit for work, short and medium term including lubrication, movement checks, leaks, component speed

##### Report

Written, Verbal

##### Condition

Suitability, working order, freedom from leaks, damaged components

## Unit 325

## Working with Land-based Machinery (Application Equipment)

### Outcome 3

Be able to test, overhaul and repair land based application machines

#### Assessment Criteria

The learner can:

1. Produce risk assessments to enable safe practices to be followed while working on **contaminated application equipment**
2. Carry out **tests** to verify the serviceability of a given range of land-based application machines
3. Carry out **repair** and **overhaul procedures** on given land based application machines

#### Range

##### Application machines

Crop Sprayers, fertilizer spreaders, slug pellet applicators, seed drills, solid and liquid manure spreaders, root crop planting equipment, planters and transplanters, irrigation equipment

#### Unit content

##### Contaminated application equipment

Equipment that has residues from the operation carried that presents a hazard e.g. chemical, residues

##### Tests

Calibration, visual, required by the manufacturer

##### Repair

Short term to ensure machine is fit for use

##### Procedures

As specified by machine manufacturers

##### Overhaul

Major repair or refurbishment of the machine

## Unit 325

## Working with Land-based Machinery (Application Equipment)

### Outcome 4

Be able to operate land based application equipment

#### Assessment Criteria

The learner can:

1. Plan **field procedures** and assess risks prior to meeting field operation objectives
2. Carry out **adjustments** and **settings** to meet specific work rates and targets using identified application equipment
3. **Report** on quality of work and suggest how changes to procedures and settings could improve the quality and **efficiency of work**

#### Range

##### Application machines

Crop Sprayers, fertilizer spreaders, slug pellet applicators, seed drills, solid and liquid manure spreaders, root crop planting equipment, planters and transplanters, irrigation equipment

#### Unit content

##### Field procedures

Operation of the equipment in a variety of field conditions, e.g. wind direction, water courses, environmental features, power lines, obstacles.

##### Adjustments and settings

Depth of work, application rates, speed, flow rates

##### Report

Written, Verbal

##### Efficiency of work

Rates, speed of operation, filling, turn round time, direction of operation, obstacles



## Unit 325

# Working with Land-based Machinery (Application Equipment)

### Notes for guidance

This unit is designed to provide the learner with a sound understanding and the necessary skills to be able to prepare the application equipment for work and carryout routine servicing, repair and overhaul, appropriate to their work context.

The learner will also be able compare application systems and operating principles and carryout test to assess the serviceability of the application equipment. 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, when delivering and assessing units where the maintenance of equipment and machinery is involved. This unit requires the learners 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.

Delivery could take the form of classroom based sessions, workshop and field based practical sessions, and links to work experience activity. The use of visiting speakers may also be considered.

For Outcome 1, the learner will gain an understanding of the function and operating principles of a range of application equipment. Whilst assessment requires a demonstration of understanding for three pieces of equipment, it is important that delivery encompasses the broad range shown in the unit content. This may require visits to see a range of equipment not found at the centre itself. Delivery also needs to include comparing the engineering solutions used in two types of equipment to meet the same end result.

In Outcome 2, the learner needs to gain the skills needed to prepare a range of application equipment for field use. This will include the initial settings and carrying out service tasks as required by the manufacturer and field conditions. The learner will also gain the skills required to inspect and report on the equipments condition and suitability for work. It is likely that delivery will be largely practically based, with learners having the supervised practical activity opportunity to prepare different equipment for a range of field conditions.

For Outcome 3, learners will be required to carry out a suitable and sufficient risk assessment before any work is carried out on the equipment and where the requirement for specific Personal Protective Equipment (PPE) is identified this should worn. The learner will need to gain the skills to carry out suitable test procedures on a range of application equipment. This should be include one type of liquid applicator and one type of solid material applicator, and learners need to verify the serviceability of the equipment (calibration) and carry out a visual inspection to identify damage and wear of components. The learner will need sufficient practice to carry out repair and overhaul procedures on different types of application equipment. Delivery is likely to be largely practical supported by classroom based theory sessions.

For Outcome 4, delivery is likely to have a high practical content, giving learners the skills to be able to operate a range of application equipment. Learners will need to be able to carry out a risk assessment

before the field operation commences and plan the work procedure for the field. The learner will need sufficient practice in carrying out infield adjustments to the equipment as required to meet application and work rates. The learner will also gain the skills to report on the quality of work achieved and make suggestions for changes in procedures and settings to improvement quality and efficiency of the work. The report may be written or verbal.

## References

### Books

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Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X  
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Manufacturers publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

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<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 326

# Working with Land-based Tool Hire Machinery and Mechanisms

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and understanding in tool and plant hire machinery and equipment and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the function and operation of tool and plant hire machinery and equipment
2. Understand maintenance requirements and schedules for tool and plant hire machinery and equipment
3. Be able to perform the handover of land-based machinery and equipment
4. Be able to inspect, maintain and service tool and plant hire machinery and equipment
5. Be able to carry out fault diagnosis and test procedures on tool and plant hire machinery and 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 Land-based service engineering NOS.

### 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 326

# Working with Land-based Tool Hire Machinery and Mechanisms

### Outcome 1

Understand the function and operation of tool and plant hire machinery and equipment

#### Assessment Criteria

The learner can:

1. Explain the **function** and operation of **small hand-held hire equipment**
2. Explain the function and operation of **non hand-held hire machinery and equipment**

#### Unit content

##### Function

The way the equipment achieves its role

##### Small hand-held hire equipment

Hand operation, electrical powered, engine powered, drills, grinders, disc cutters, cut off saws, sanders, polishers, planers, chainsaws, brush cutters, circular saws, jig saws, thread cutting equipment, sprayers

##### Non hand-held machinery

Non-ride on, ride on, electrical powered, engine powered, cement mixers, wacker plates, rollers, compacters, shredders, chippers, grinders, mowers, powered barrows, compressors, fork lift trucks

##### Equipment

Non powered: ladders, steps, scaffolding, tower scaffolds, chains, straps, barrows, pallet trucks

## Unit 326

# Working with Land-based Tool Hire Machinery and Mechanisms

## Outcome 2

Understand maintenance requirements and schedules for tool and plant hire machinery and equipment

### Assessment Criteria

The learner can:

1. Explain the **maintenance** requirements of **small hand-held hire equipment**
2. Explain the maintenance requirements of **non hand-held hire machinery and equipment**

### Unit content

#### Maintenance

Routine, non routine, daily, periodic

#### Small hand-held hire equipment

Hand operation, electrical powered, engine powered, drills, grinders, disc cutters, cut off saws, sanders, polishers, planers, chainsaws, brush cutters, circular saws, jig saws, thread cutting equipment, sprayers

#### Non hand-held machinery

Non-ride on, ride on, electrical powered, engine covered, cement mixers, wacker plates, rollers, compacters, shredders, chippers, grinders, mowers, powered barrows, compressors, fork lift trucks

#### Equipment

Non powered: ladders, steps, scaffolding, tower scaffolds, chains, straps, barrows, pallet trucks

## **Unit 326                      Working with Land-based Tool Hire Machinery and Mechanisms**

**Outcome 3                      Be able to perform the handover of land-based machinery and equipment**

### **Assessment Criteria**

The learner can:

1. Carry out **pre-delivery inspection** of machinery and equipment
2. Explain to user **safe operation** and **maintenance** of **small hand-held hire equipment**
3. Explain to user safe **operation** and **maintenance** of **non hand-held machinery and equipment**

### **Unit content**

#### **Pre delivery inspection**

Inspection carried out to ensure suitability for use, new equipment, used equipment

#### **Safe operation**

As require by legislation, risk assessment, manufacturers instructions, Personal Protective Equipment (PPE), RCD, emergency procedures, safe handling

#### **Maintenance**

Daily, periodic, fuelling, inspection, sharpening, cleaning, changing components (discs, blades) lubrication, tyre pressures cooling

#### **Small hand-held hire equipment**

Hand operation, electrical powered, engine powered, drills, grinders, disc cutters, cut off saws, sanders, polishers, planers, chainsaws, brush cutters, circular saws, jig saws, thread cutting equipment, sprayers

#### **Non hand-held machinery**

Non-ride on, ride on, electrical powered, engine powered, cement mixers, wacker plates, rollers, compacters, shredders, chippers, grinders, mowers, powered barrows, compressors, fork lift trucks

#### **Equipment**

Non powered: ladders, steps, scaffolding, tower scaffolds, chains, straps, barrows, pallet trucks

## **Unit 326                      Working with Land-based Tool Hire Machinery and Mechanisms**

**Outcome 4                      Be able to inspect, maintain and service tool and plant hire machinery and equipment**

### **Assessment Criteria**

The learner can:

1. **Safely inspect, maintain and service selected small hand-held hire equipment** using **manufacturers' service data**
2. Safely inspect, maintain and service selected **non hand-held hire machinery and equipment** using manufacturers' service data.

### **Unit content**

#### **Safely**

As required by manufacturers guidance, risk assessment, company policy, legislation

#### **Inspect**

Visual, auditory, touch, smell, test run, competent person

#### **Maintain**

Serviceable condition of equipment

#### **Service**

Minor, major, routine, non-Routine

#### **Manufacturer's service data**

Technical bulletins, service manuals, service schedules, workshop manuals

#### **Small hand-held hire equipment**

Hand operation, electrical powered, engine powered, drills, grinders, disc cutters, cut off saws, sanders, polishers, planers, chainsaws, brush cutters, circular saws, jig saws, thread cutting equipment, sprayers

#### **Non hand-held machinery**

Non-ride on, ride on, electrical powered, engine powered, cement mixers, wacker plates, rollers, compactors, shredders, chippers, grinders, mowers, powered barrows, compressors, fork lift trucks

#### **Equipment**

Non powered: ladders, steps, scaffolding, tower scaffolds, chains, straps, barrows, pallet trucks

## **Unit 326                      Working with Land-based Tool Hire Machinery and Mechanisms**

**Outcome 5                      Be able to carry out fault diagnosis and test procedures on tool and plant hire machinery and equipment**

### **Assessment Criteria**

The learner can:

1. Safely carry out **fault finding** and **testing procedures** on selected **small hand-held equipment**
2. Safely carry out **fault finding** and **testing procedures** on selected **non-hand-held machinery and equipment**
3. **Report** on **status** of machinery and equipment as a **result** of tests carried out

### **Unit content**

#### **Fault finding**

Major, minor, intermittent, continuous

#### **Testing procedures**

Visual, auditory, touch, smell, test run, required by manufacturer, test equipment, engine tests, compression test, electrical systems, electronic systems, cooling systems, fuel systems, transmission system, hydraulic systems, PAT Testing

#### **Small hand–held hire equipment**

Hand operation, electrical powered, engine powered, drills, grinders, disc cutters, cut off saws, sanders, polishers, planers, chainsaws, brush cutters, circular saws, jig saws, thread cutting equipment, sprayers

#### **Non hand–held machinery**

Non-ride on, ride on, electrical powered, engine powered, cement mixers, wacker plates, rollers, compacters, shredders, chippers, grinders, mowers, powered barrows, compressors, fork lift trucks

#### **Equipment**

Non powered: ladders, steps, scaffolding, tower scaffolds, chains, straps, barrows, pallet trucks

#### **Report**

Written, verbal

#### **Status**

Condition of equipment, fit for purpose, legislative requirements

#### **Results**

From any suitable test carried out to find faults, comparison to manufacturers specifications



# **Unit 326                      Working with Land-based Tool Hire Machinery and Mechanisms**

## **Notes for guidance**

This unit is designed to provide the learner with a sound understanding and the necessary skills to be able to prepare the land-based tool hire equipment and mechanisms for work, carry out routine servicing, maintenance, testing, fault finding and repair appropriate to their work context.

The learner will also be carryout pre delivery inspection, handover procedures and give instruction and guidance to the customer. 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.

Delivery of the unit could take the form of classroom based sessions, workshop practical sessions, work experience or simulations within the learning environment. The use of visiting speakers may also be considered to benefit the delivery of the outcome.

All learners will be expected to use machinery and equipment of similar complexity to allow fairness of assessment

In Outcome 1 the learner will be able to explain the function and operation of small items of hand held hire equipment. The learner will also be able to explain the function and operation of non hand- held pieces of machinery and equipment. The lists in the unit content are not exhaustive and equipment and machinery appropriate to the learner may be used.

In Outcome 2 the learner will be able to explain the maintenance requirements for the machinery and equipment selected in outcome 1. This must include any maintenance that is required by legislation, codes of practice, company procedures and as laid down by the machinery or equipment manufacturer.

In Outcome 3 the learner will be able to perform the handover procedures for equipment and machinery chosen in Outcome 1. This must include hand-held, non hand held and equipment from or machinery. The learner will be able to carry out the required pre-delivery inspection for the selected items, be able to explain to the user the safe operation and the user maintenance of the selected.

In Outcome 4 the learner will be able to safely inspect, maintain and service the machinery and equipment, hand held and non hand held, (use of the equipment and machinery as described in Outcome 1 should be seen as good practice). This should be in accordance with the manufacturer's data, service schedules and workshop manuals.

In Outcome 5 the learner will be able to safely carry out fault diagnosis and test procedures. This must include sensory tests and the use of diagnostic equipment. The fault diagnosis and tests should be carried out on small hand held machinery and equipment, non hand held machinery and equipment. The learner will be able to report on the status of the machinery and equipment as a result of the tests. The report may be written or verbal, whichever is appropriate for the tests carried out.

With any of the test and inspection procedures carried out suitable risk assessment should be carried out and safe working practices and procedures followed, the procedures as required by the machinery

and equipment manufacturers should be followed and evidence of the use of manufacturer's guidance and recommendations should be available.

## Unit 327

# Understanding and Working with Groundcare Equipment

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and understanding in groundcare equipment and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the purpose and operation of groundcare equipment
2. Be able to safely operate groundcare equipment
3. Be able to maintain and repair equipment to establish and maintain grass surfaces
4. Be able to maintain and repair equipment used to cut grass

### 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 Land-based service engineering NOS.

### 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 327                      Understanding and Working with Groundcare Equipment**

Outcome 1                      Understand the purpose and operation of groundcare equipment

### **Assessment Criteria**

The learner can:

1. Explain the **principles of operation** of given grass surface **establishment and maintenance equipment**
2. Explain the principles of operation of given **grass cutting equipment**

### **Range**

Pedestrian controlled, ride-on and trailed equipment

### **Unit content**

#### **Principles of operation**

Centrifugal, rotary, cylinder

#### **Establishment and maintenance equipment**

Rotary cultivation equipment, levelling equipment, drainage and aeration equipment, sub-soil equipment, stone pickers, scarifiers, mowers, groomers, rotavators, fertiliser distributors/ spreaders, sprayers, seeding equipment, irrigation equipment, strimmers, mowing machinery (fine turf, professional and domestic)

#### **Grass cutting equipment**

Strimmers, mowers (fine turf, cylinder, rotary), centrifugal cutting systems (flails, chains and cords)

## Unit 327

## Understanding and Working with Groundcare Equipment

### Outcome 2

Be able to safely operate groundcare equipment

#### Assessment Criteria

The learner can:

1. Safely operate given grass surface **establishment and maintenance equipment**
2. Safely operate given **grass cutting equipment**

#### Range

Pedestrian controlled, ride-on and trailed equipment

#### Unit content

##### Principles of operation

Centrifugal, rotary, cylinder

##### Establishment and maintenance equipment

Rotary cultivation equipment, levelling equipment, drainage and aeration equipment, sub-soil equipment, stone pickers, scarifiers, mowers, groomers, rotavators, fertiliser distributors/ spreaders, sprayers, seeding equipment, irrigation equipment, strimmers, mowing machinery (fine turf, professional and domestic)

##### Grass cutting equipment

Strimmers, mowers (fine turf, cylinder, rotary), centrifugal cutting systems (flails, chains and cords)

## Unit 327

## Understanding and Working with Groundcare Equipment

### Outcome 3

Be able to maintain and repair equipment to establish and maintain grass surfaces

#### Assessment Criteria

The learner can:

1. Safely carry out (using manufacturers service data) **routine maintenance equipment** to given **objectives**
2. Safely repair equipment to given objectives

#### Unit content

##### Routine maintenance

Daily, periodic and operational maintenance

##### Equipment

Rotary cultivation equipment, levelling equipment, drainage and aeration equipment, sub-soil equipment, stone pickers, scarifiers, groomers, rotavators, fertiliser distributors/ spreaders, sprayers, seeding equipment, irrigation equipment

##### Objectives

Manufacturer's specifications, operational requirements

## Unit 327

## Understanding and Working with Groundcare Equipment

### Outcome 4

Be able to maintain and repair equipment used to cut grass

#### Assessment Criteria

The learner can:

1. Safely carry out (using manufacturers' service data) **routine maintenance of equipment used to cut grass**
2. Safely repair **equipment used to establish and maintain grass surfaces**

#### Unit content

##### Routine maintenance

Daily, periodic and operational maintenance

##### Equipment used to cut grass

Strimmers, mowers (fine turf, cylinder, rotary), centrifugal cutting systems (flails, chains and cords)

##### Equipment used to establish and maintain grass surfaces

Rotary cultivation equipment, levelling equipment, drainage and aeration equipment, sub-soil equipment, stone pickers, scarifiers, mowers, groomers, rotavators, fertiliser distributors/ spreaders, sprayers, seeding equipment, irrigation equipment, strimmers, mowing machinery (fine turf, professional and domestic)

## **Unit 327                      Understanding and Working with Groundcare Equipment**

### **Notes for guidance**

This unit looks at the equipment used in ground care, domestic and professional. These are split into two groups the equipment used for establish and maintain grass surfaces, and the equipment used to cut the grass.

The learner will understand the purpose and operation of ground care machinery, as well as operate, maintain, and repair the same machinery.

Centres and tutors need to be aware of the need to safeguard 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.

All operation, maintenance and repair must be done following manufacturer's guidelines and manuals, as well as conforming to all Health and Safety guidelines. The learner should have access to a full range of ground care machinery.

In Outcome 1 looks at the principles of operation of all ground care machinery. The delivery of this outcome will be a mixture of classroom based theory and practical demonstrations. This would benefit the learner by developing their understanding on how to use the machinery, safely, and when such machinery should be used and for what purpose.

Outcome 2 takes the knowledge learnt in Outcome 1 and puts it into practice, with the learner using the principles already learnt by operating safely various equipment involved in establishment, maintenance and cutting of grass surfaces. Tutors should ensure Personal Protective Equipment (PPE) is used correctly, and the machinery is operated correctly, with the correct outcome.

In Outcome 3, using machinery covered in from Outcomes 1 and 2 the learner will carry out, following manufacturer's guidelines, repair and routine maintenance of these grass establishment and maintenance machinery. The delivery of this will be practical based and learners will need suitable areas needed to cover all aspects of grass establishment and maintenance.

In Outcome 4 the learner will use the machinery covered in Outcomes 1 and 2 to carry out, following manufacturer's guidelines, repair and routine maintenance of grass cutting machinery. The delivery of this will be practical based and learners will need suitable areas needed to cover all aspects of grass establishment and maintenance.



## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 328

# Undertaking 4WD Vehicle Maintenance, Operation and Recovery

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in working with 4WD vehicles and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

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

### 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 Land-based service engineering (NOS).

### 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 328                      Undertaking 4WD Vehicle Maintenance, Operation and Recovery**

**Outcome 1                      Understand common features and specifications of a 4WD vehicle**

### **Assessment Criteria**

The learner can:

1. Explain the **features and specifications of a 4WD vehicle**
2. Discuss **situations** where these features would be used

### **Unit content**

#### **Features and specifications of a 4WD vehicle**

Engine: fuel and size

Gearbox: Automatic/manual, number of speeds

Transfer box: 2/4 wheel drive, central differential

Differential: open, locking, plate type LSD, Helical LSD, ramp type LSD

Axles/suspension Leaf springs, coils springs, air springs, independent axles, beam axles, articulation

Tyres: size and tread pattern, pressure

Electronic driving aids: traction control, incline decent assistance

Dimensions: ramp over angle, approach angle, departure angle

Safety devices

#### **Situations**

Terrain: soil type, inclination, soil moisture, ruts, wet spots,

## Unit 328

# Undertaking 4WD Vehicle Maintenance, Operation and Recovery

## Outcome 2

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

### Assessment Criteria

The learner can:

1. Assess the **condition** of a 4WD vehicle
2. Carry out **routine maintenance** of a 4WD vehicle according to manufacturer's instructions.

### Unit content

#### Condition

Readiness of the vehicle to be used with special attention to mechanical/electrical units unique to the 4WD system

#### Routine maintenance

Daily, weekly, monthly and annual maintenance, plus extra checks needed after off road use

## Unit 328

# Undertaking 4WD Vehicle Maintenance, Operation and Recovery

## Outcome 3

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

### Assessment Criteria

The learner can:

1. Review the extent to which the **features of a 4WD vehicle** enable it to operate in **off-road situations**
2. Safely **operate** a 4WD vehicle in on and off-road situations

### Unit content

#### Features of a 4WD vehicle

Engine: fuel and size

Gearbox: Automatic/manual, number of speeds

Transfer box: 2/4 wheel drive, central differential

Differential: open, locking, plate type LSD, Helical LSD, ramp type LSD

Axles/suspension Leaf springs, coils springs, air springs, independent axles, beam axles, articulation

Tyres: size and tread pattern, pressure.

Electronic driving aids: traction control, incline decent assistance

Dimensions: ramp over angle, approach angle, departure angle

Safety devices

#### Off-road situations

Terrain, slopes, water (standing and running)

#### Operate

Drive to conditions, paying attention to vehicle sympathy, operator safety and comfort and environmental conditions pre and post operation, with respect for others and the environment

## Unit 328

## Undertaking 4WD Vehicle Maintenance, Operation and Recovery

### Outcome 4

Be able to recover a 4WD vehicle

#### Assessment Criteria

The learner can:

1. Review options for recovering 4WD vehicles from **typical situations**
2. Safely **recover** a 4WD vehicle

#### Unit content

##### Typical situations

Stuck in mud, Cross rutted, water ingress in engine, loss of traction, grounding out and cross axle

##### Recover

Drive out, dig out, Jack out, pull out with rope and another vehicle, winch out

# Unit 328                      Undertaking 4WD Vehicle Maintenance, Operation and Recovery

## Notes for guidance

This unit is designed to give the learner knowledge and skills required to prepare, service/maintain operate and recover 4WD vehicles paying particular attention to the unique features of 4WD vehicles. Outcome 1 looks at the 4WD features and specifications and at the situation, where these features feature can be used on off road driving. This part is a theory based, but need to be backed up by visual aids and availability of vehicles for the students to study and appreciate different vehicle specifications between various 4WD vehicles and also between on road vehicles.

Outcome 2 allows the learner to assess the condition of 4WD vehicles, and their readiness of them to drive off road, and carry out routine maintenance (cleaning and servicing). This is a workshop based activity requiring vary types of 4WD vehicles allowing learners to see and work on different specification 4WDs and appreciate their differences.

Outcome 3 allows the review different features on 4WD and how they enable the vehicle to operate of road, this part of the Outcome is theory and practical demonstration based, The second part of this outcome allows the learner to operate 4WD vehicles. This must involve different vehicles and different terrains and inclinations. This is a practical Outcome and best taught in small groups to ensure learner safety and learning.

Outcome 4 looks at recovering 4WD vehicles. All aspects of 4WD recovery must be covered, in this theory and practical Outcome. For the practical part of this Outcome can be taught with Outcome 3 again in small groups to ensure learner safety and learning

### References

#### Books

- Cole N — Off-road Recovery Techniques: A Practical Handbook on Principles and Use of Equipment (Motor Racing Publications, 1996) ISBN 189987013X  
Dimbleby N — Off-road Driving Techniques (The Crowood Press, 1997) ISBN 1861260520  
Hawker M and Keenlyside J — Horticultural Machinery, 3rd Edition (Longman, 1985) ISBN 0582408075  
Sheppard T — Off-roader Driving (Desert Winds, 1999) ISBN 0953232425

#### Websites

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|--|---|
| <a href="http://www.bagma.com">www.bagma.com</a>   | British Agricultural and Garden Machinery Association |
| <a href="http://www.borda.org.uk">www.borda.org.uk</a>   | British Off-Road Driving Association                  |
| <a href="http://www.defra.gov.uk">www.defra.gov.uk</a>   | Department for Environment, Food and Rural Affairs    |
| <a href="http://www.howstuffworks.com">www.howstuffworks.com</a>   | How Stuff Works                                       |
| <a href="http://www.hse.gov.uk">www.hse.gov.uk</a>   | Health and Safety Executive                           |
| <a href="http://www.iagre.org">www.iagre.org</a>   | Institution of Agricultural Engineers                 |
| <a href="http://www.lantra.co.uk">www.lantra.co.uk</a>   | Lantra Sector Skills Council                          |
| <a href="http://www.difflock.com/offroad/drivingoffroad.shtml">www.difflock.com/offroad/drivingoffroad.shtml</a> |   |

#### DVD

How to drive off road-Land rover owner **ASIN:** B0006M4RX8

## Unit 329

# Familiarisation and Management of Land-based Vehicles

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to land-based vehicle management skills and knowledge and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the specialist features and characteristics of commonly used land-based vehicles
2. Know the legal constraints governing the operation and use of land-based vehicles
3. Be able to operate land-based vehicles to allow service and repair tasks to be performed
4. Understand the managerial aspects of ownership of land-based vehicles

### 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 Land-based Engineering National Occupational Standards.

### 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 329                      Familiarisation and Management of Land-based Vehicles**

Outcome 1                      Understand the specialist features and characteristics of commonly used land-based vehicles

### **Assessment Criteria**

The learner can:

1. Explain specialist features and characteristics of selected commonly used **land-based vehicles**
2. Analyse **machine specifications** for selected land-based machines

### **Unit content**

#### **Land based vehicles**

Hand held, pedestrian, self propelled, mounted, trailed machines

#### **Machine specifications**

Features on LBV designed to accomplish the required work (e.g. size, weight, engine size, type, drive line)

## Unit 329

## Familiarisation and Management of Land-based Vehicles

### Outcome 2

Know the legal constraints governing the operation and use of land-based vehicles

#### Assessment Criteria

The learner can:

1. Describe the **legal constraints** associated with the **operation** and use of given **land-based vehicles**
2. Identify **safety features** in the design of **land-based vehicles**

#### Unit content

##### Legal constraints

LBV type, size, speed, weight

Highway Code

Operator age, operator training/certificates/licences

Health and safety

Machine tests/certificates, safety features, operating environment

##### Operation

Preparation for work: field use, road use, use of implements

##### Land-based vehicles

Pedestrian, self propelled, mounted, trailed machines

##### Safety features

ROPS (rollover protective structure) with seatbelt, posture-designed seat, lighting for highway and field, SMV (slow moving vehicle) sign, flashing amber hazard lights, turn signals, fenders, engine shrouding, PTO master shield, PTO stub shaft shield, manual override power steering, neutral start interlocking switch, steps with handholds, hazard warning decals, and breakaway hydraulic couplers

## **Unit 329                      Familiarisation and Management of Land-based Vehicles**

**Outcome 3                      Be able to operate land-based vehicles to allow service and repair tasks to be performed**

### **Assessment Criteria**

The learner can:

1. Operate given **land-based vehicles** in confined spaces to allow **service and repair tasks** to be performed
2. Undertake **risk assessment** appropriate to vehicle operation

### **Unit content**

#### **Land based vehicles**

Pedestrian, self propelled, mounted, trailed machines

#### **Service and repair tasks**

Daily, weekly monthly and annual service, wearing part replacement, breakdown repair

#### **Risk assessment**

Careful examination of what, could cause harm to people, so it can be weighed up whether enough precautions have been taken. Record in a manner others can see the risks involved easily

## Unit 329

## Familiarisation and Management of Land-based Vehicles

### Outcome 4

Understand the managerial aspects of ownership of land-based vehicles

#### Assessment Criteria

The learner can:

1. Explain **managerial aspects** of **land-based vehicle ownership**
2. Discuss **service and maintenance** planning for selected land-based vehicles

#### Unit content

##### Managerial aspects

Costing, planning servicing, planning replacement. Complying to laws and legislation

##### Land based vehicles

Pedestrian, self propelled, mounted, trailed machines

##### Service and maintenance

Routine inspection, servicing and replacement of wearing parts

# Unit 329                      Familiarisation and Management of Land-based Vehicles

## Notes for guidance

This unit looks the special features and characteristics that set land-based vehicles aside from others. The laws and legislation covering these vehicles and their operators are explained to the learners, as well as other aspects covering the management of land-based vehicles.

The practical part of this unit enables the learner to operate service and repair LBVs. As with all practical's, Health and safety must be observed at all times part of Outcome 3 allows the learner to create a risk assessment, helping to instil a safety ethic in their work.

Centres and tutors need to be aware of the need to safeguard 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.

Outcomes 1, 2 and 4 are linked and can be taught at the same time, assisted with visit or guest speakers, (law enforcement officer for example). A full range of land-based vehicles and implements must be available to ensure the learner has a broad understanding of the unit.

Outcome 3 is mainly practical based, but referral back to the other outcomes may be needed for a full understanding of the unit.

As this unit involves operation of land based vehicles, the learner/tutor ratio must be closely governed to ensure safe practice at all times.

### References

#### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> edition*. Blackwell Scientific. ISBN 063203159X  
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Whipp J and Brooks R — *Transmission, Chassis and Related Systems (Vehicle Maintenance and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X  
Manufacturers publications and manuals

#### Journals

- Farmers Guardian  
Profi International  
Farmers Weekly

## Websites

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<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers
<a href="http://www.direct.gov.uk">www.direct.gov.uk</a>	Driving Licence and Laws

## Unit 330

# Understanding Computer Application and Control in Land-based Technology

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to introduce learners to the skills and knowledge in land-based computer application and control systems and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

### Learning outcomes

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

1. Understand the application and operation of components used in land-based computer application and control systems
2. Understand the function of land-based computer application and control systems
3. Be able to set and adjust land-based computer application and control systems
4. Be able to test and repair land-based computer application and control systems

### 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.

This unit is linked to the Land-based Engineering National Occupational Standards.

### 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 330                      Understanding Computer Application and Control in Land-based Technology**

Outcome 1                      Understand the application and operation of components used in land-based computer application and control systems

### **Assessment Criteria**

The learner can:

1. Identify the **main component parts** of given **digital control systems**
2. Explain the **operation and interaction** of given digital control systems

### **Unit content**

#### **Main component parts**

Sensors; pressure, velocity, Strain, flow, proximity, displacement, vibration, temperature, RPM, force, resistance switches

Processors /digital control unit; ECU, ECM, Canbus system

Signal convertors; voltage to voltage, voltage to current, analogue to digital, digital to digital

Displays; LCD, Colour, LED, warning light, analogue gauge

#### **Digital control systems**

Engine, suspension, transmission, power take off, hydraulic, steering, application control

#### **Operation and interaction**

How the controllers talk to each other and receive signals from sensor, and operators



## Unit 330

# Understanding Computer Application and Control in Land-based Technology

## Outcome 2

Understand the function of land-based computer application and control systems

### Assessment Criteria

The learner can:

1. Explain the **function** of selected **application and control systems**
2. Explain the **operation** of selected application and control systems

### Unit content

#### Function

Signal generation and transmission; how these signals are translated, and into what, End result of the signal

#### Application and control systems

Control: Engine, suspension, transmission, power take off, hydraulic, steering  
Application control: liquid, prills, compounds

#### Operation

How the components interact with each other

## Unit 330

# Understanding Computer Application and Control in Land-based Technology

## Outcome 3

Be able to set and adjust land-based computer application and control systems

### Assessment Criteria

The learner can:

1. **Set and adjust** given **digital control systems**

### Unit content

#### Set and adjust

System set up, and primary calibrations. How the system compensates for differing received signals from sensors, and operator adjustments

#### Digital control systems

Engine, suspension, transmission, power take off, hydraulic, steering, application control

## **Unit 330                      Understanding Computer Application and Control in Land-based Technology**

**Outcome 4                      Be able to test and repair land-based computer  
application and control systems**

### **Assessment Criteria**

The learner can:

1. Carry out **test procedures** in given computer **application and control systems**
2. Repair faults found in given computer application and control systems
3. **Collect and collate test data** to assess the condition of selected computer application and control components

### **Unit content**

#### **Test procedures**

Voltage, current, resistance checks

Retrieving error codes

Using Laptop and manufacturer's software to run test programmes

#### **Application and control systems**

Control: Engine, suspension, transmission, power take off, hydraulic, steering,

Application control: liquid, prills, compounds

#### **Faults**

Error codes, warning lights, audible warning, components not working

#### **Collect and collate test data**

Data logging, error codes, manual logging of data, remote data collection

# Unit 330                      Understanding Computer Application and Control in Land-based Technology

## Notes for guidance

This unit provides the knowledge and skills needed to understand the function and operation of computerised application and control systems' assemblies and components. The improved efficiency of the land-based equipment and component will be identified and the health and safety issues encountered when carrying out service and repair activities will be stressed during the delivery of this unit.

Centres and tutors need to be aware of the need to safeguard 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.

Outcome 1 looks at the application and operation of components used in land-based computer control systems. To aid component identification examples should be available for the learner

Outcome 2 expands on Outcome 1 by looking at the function and operation of assemblies used in land based computer application and control systems.

Outcome 1 and 2 are lecture based and can be combined if required.

Outcomes 3 and 4 are practical based. A good knowledge of the systems used is important, and the capability of applying non damaging errors. The learners will need to look at the set-up, calibration, testing and repair of land based computer application and control systems. Learners are expected to undertake practical studies to gain experience in application and control service and repair methods. Learners will be able to interpret land-based computer application and control workshop manuals and carry out service and repair tasks safely and efficiently. Nowadays the use of laptop based diagnostic software is on the increase, for the testing, diagnostics, and reprogramming of machinery electronic control units. This software is not readily available out of the dealer network, so a visiting specialist may be required to demonstrate the software and its capabilities.

### References

#### Books

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

Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X

Manufacturers' publications and manuals

## **Journals**

Farmers Guardian  
Profi International  
Farmers Weekly

## **Websites**

<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

**Level:** 3

**Credit value:** 10

**Unit aim**

This unit aims to introduce learners to the skills and knowledge in machinery selection, sourcing, legislation and finance and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

**Learning outcomes**

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

1. Understand selection criteria for machinery
2. Understand acquisition of land-based machinery
3. Understand measures for determining the efficiency and financial costs of machinery operation
4. Understand regulation that affects the ownership and operation of land-based 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**

This unit is linked to the Land-based service engineering NOS.

**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 331

### Outcome 1

## Understanding Land-based Machinery Management

### Understand selection criteria for machinery

#### Assessment Criteria

The learner can:

1. **Explain** the **factors** that should be considered when selecting appropriate **land-based machinery**
2. Determine selection **criteria** for land-based machinery

#### Unit content

##### Explain

Written or Verbal

##### Factors

Operations required, performance required, local dealerships, sales staff, lead time, spares supply, market share, user reports, peer reports, personal recommendation, technical reports, press reports, personal preference, brand loyalty

##### Land-based machinery

Tractors, combine harvester, sugar beet and other root harvesters, sprayers, fertilizer spreaders, tele-handlers, forage harvesters, mowers, rakes/tedders, ploughs, cultivation equipment, trailers, feeder, wagons, muck spreaders, Irrigators, seed drills, balers, timber harvesters, forwarders, grounds maintenance equipment

##### Criteria

Use level, hours per year, all year or seasonal, operating costs, replacement costs, work rates required, work rates achievable, resale value, legal restrictions, training required, operator competence, crops, ground/soil conditions, primary use, additional uses, life span, depreciation, personal preference, environmental impact

**Unit 331**  
Outcome 2

**Understanding Land-based Machinery Management**  
Understand acquisition of land-based machinery

**Assessment Criteria**

The learner can:

1. Examine **sources** for obtaining machinery
2. Discuss **financial options** for obtaining machinery

**Unit content**

**Sources**

Farmer co-operative, machinery rings, hire, lease, contract hire, seasonal hire, local dealer, national supplier, specialist supplier, manufacturer

**Financial options**

Purchase, lease, hire purchase, bank loan, self funding, short term hire, long term hire



**Unit 331**  
Outcome 3

**Understanding Land-based Machinery Management**  
Understand measures for determining the efficiency and financial costs of machinery operation

**Assessment Criteria**

The learner can:

1. Explain methods of **measuring efficiency** of machine operation
2. **Calculate costs** associated with machine operation

**Unit content**

**Measuring efficiency**

Work rates, fuel consumption, application rates, manufacturer's data, speed of operation, output per hour, output per litre of fuel, hectares per hour, hectares per day, calibration

**Calculate**

Use accepted formulae and standards as appropriate

**Costs**

Replacement costs, depreciation, spares costs, wearing parts, fuel costs, running costs, purchase costs, licence requirements

## Unit 331

### Outcome 4

## Understanding Land-based Machinery Management

Understand regulation that affects the ownership and operation of land-based machinery

### Assessment Criteria

The learner can:

1. Explain how relevant **codes of practice** and legal requirements influence machinery ownership and operation
2. State the **legal requirements** for taking machinery on the **highway**

### Unit content

#### Codes of Practice

Legislative, Provision and Use of Work Equipment Regulations, Lifting Operations and Lifting Equipment Regulations, Noise at Work Regulations, Whole Body Vibration Regulations, Control of Substances Hazardous to Health regulations, Voluntary, Industry Led, (i.e. Pesticides Code of practice, BAGMA code of practice for Tractor maintenance) Crop Assurance Schemes, Customer led, Consumer led, Health and Safety Executive (HSE), National Sprayer Testing Scheme (NSTS)

#### Legal requirements

Construction and Use Regulations, Highways Act, Braking Requirements, Driver licensing, Vehicle Excise Duty, Operators License, Width, Weight, Length restrictions, Use of rebated Fuel, Agricultural Restrictions, Definitions of Agricultural Tractors and other Agricultural machines and equipment, Marking of Extremities, Escort Vehicle, Police Notification, Operator awareness

#### Highway

Any part of a road that is open to the public, single carriageway, dual carriageway, rural areas, built up areas

## **Unit 331                      Understanding Land-based Machinery Management**

### **Notes for guidance**

This unit is designed to provide the learner with a sound knowledge and the necessary skills to be able to understand and explain the management, acquisition options and the legal requirements affecting ownership and operation both on the farm and on the highway for land-based machinery appropriate to the learners work context. The teaching will need to cover a range of machinery appropriate to the learners background. This could be in the context of arable, livestock, forestry or vegetable production, sports turf or Amenity Horticulture or any other production system as appropriate to the learners' background.

The learner will be expected to be familiar with the requirements of current legislation that affects the ownership and operation of land-based machinery.

Delivery this can take the form of classroom based sessions, visits to relevant businesses, in work evaluation and assessment of the machines performance. The use of visiting speakers may also be considered.

Outcome 1 the learner will be able to explain the factors that should be considered when selecting land-based machinery. The learner will be able to determine and explain the criteria that may influence the selection of the machinery.

Outcome 2 the learner will be able to examine the sources available for the obtaining of land-based machinery. The learner will be able to investigate and discuss the financial options for obtaining the machinery and be able to explain the reasons for a preferred option. This should be for the machines chosen for Outcome 1.

Outcome 3 the learner will be able to explain the methods available for measuring the efficiency of machine operation. This again could use the machine identified in Outcome 1. The learner will also be able to calculate costs, using recognised methods and formulae.

Outcome 4 the learner will need to explain the legal requirements/codes and how these influence the ownership and operation of the machinery identified in Outcome 1. The learner will also be able to state the legal requirements, for the movement of the identified machinery on the highway. This must include operator licensing requirements, any width length and weight restrictions that may be a legal requirement either as a result of legislation or as a restriction caused by the operators age or licence category. The learner will also be able to identify any restrictions that may be placed on taking the machines on the road and the use of rebated fuel.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X
- Manufacturers publications and manuals

### Journals

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### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

**Level:** 3

**Credit value:** 10

**Unit aim**

The learner will look at the business, the role and responsibilities of those employed in land-based businesses and resource requirements. They will develop their skills in business operations and produce a business plan.

**Learning outcomes**

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

1. Know the breadth and importance of an industry in the environmental and land-based sector
2. Understand business resources and structures
3. Understand the business marketplace
4. Understand how to use financial and physical record keeping systems

**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 332

### Outcome 1

## Business Management in the Land-based Sector

Know the breadth and importance of an industry in the environmental and land-based sector

### Assessment Criteria

The learner can:

1. Describe the **importance** of businesses within the industry **to the economy**
2. Outline the range of **associated businesses** allied to the industry

### Unit content

#### Importance to the economy

Using measures available to the industry, e.g. value of output, contribution to Gross Domestic Product (GDP), employment, land use, economic and social benefits, trends in importance

Range of organisations: typical types of businesses and other organisations (e.g. representative, regulatory, not-for-profit) within the sector, regional variations, changes and developments in the last 50 years

#### Associated businesses

Relevant industries in primary, secondary and tertiary industrial sectors (e.g. suppliers of raw materials, processors, distributors, retailers, service providers)

Associated organisations: specific interrelationships between one business and other associated organisations e.g. suppliers of goods and services, representative organisations and professional bodies, regulatory bodies, competitors, customers, aims and roles of important organisations in the sector

**Assessment Criteria**

The learner can:

1. Explain the **legal structure and organisation** of a land-based business
2. Explain the **physical resource requirements** of a selected land-based business
3. Describe different **job roles and responsibilities** in a selected land-based business

**Unit content**

**Legal structure and organisation**

Features of the main business types, e.g. sole trader, partnership, limited company, not-for-profit organization, charity, public sector organisations, organization staffing structure

**Physical resource requirements**

Property (forms of tenure, appraisal of business potential), vehicles and machinery, tools and equipment, stocks (stock control procedures), insurance of physical resources

**Job roles and responsibilities**

Job roles relevant to the sector, e.g. director, manager, supervisor, team worker, trainee, administrator, volunteer, sub contractor, job title, job description, responsibilities for financial, physical and human resources, staff motivation and performance management, person specification (typical skills, qualifications and experience required to fulfil the role), legal rights and responsibilities in work (e.g. pay, working hours, holidays, equal opportunities, health and safety, employment protection), relevant employment legislation

**Assessment Criteria**

The learner can:

1. Describe the **marketplace, customers and competitors** for a land-based business
2. Explain features of an efficient **supply chain** in a land-based context
3. Review **quality management** systems and practices within a land-based business

**Unit content**

**Marketplace, customers and competitors**

Size of market (e.g. value of sales, number of customers), external influences on the market (political, economic, socio-cultural, technological), customer base (number, type, characteristics, market segments), direct and indirect competitors, competitor analysis, market share

**Supply chain**

Suppliers, distributors, customers, choosing suppliers, ensuring supplies of inputs, supply chain assurance (e.g. environmental, animal welfare)

**Quality management**

Important aspects of quality in the sector, formal quality standards or approval (e.g. Farm Assured, ISO 9000, BHS approval), informal systems and practices to achieve quality, problems arising if quality is not achieved



**Unit 332**  
Outcome 4

**Business Management in the Land-based Sector**  
Understand how to use financial and physical record keeping systems

**Assessment Criteria**

The learner can:

1. Review **financial records** for a selected land-based business
2. Examine **physical records** for a selected land-based business
3. Examine the use of financial and physical records in **monitoring business performance and progress**

**Unit content**

**Financial records**

Importance of keeping accurate records (legal requirements and management efficiency), purchasing and ordering procedures, order forms and orders, deliveries and receipts, invoices and sales records, credit control, payment methods, bookkeeping (cash analysis, petty cash, cash flow, budgets, computer accounts programmes), basic accounts (trading account, balance sheet, depreciation), taxation (VAT, income tax PAYE, national insurance contributions, corporation tax), wage calculation

**Physical records**

Records appropriate to the industry relating to e.g. production, inputs, staffing, customers, resource use, data protection, legal requirements to keep records, e.g. pesticide use, veterinary medicines, transport, animal movement, passports

**Monitor business performance and progress**

Use of financial and physical records to monitor business performance, e.g. production levels, costs of production, financial efficiency, monitoring against targets, budgets, previous periods, relevant review periods (e.g. weekly, monthly, annually), appropriate remedial actions, staff roles in recording and analysing information

## Unit 332 Business Management in the Land-based Sector

### Notes for guidance

This unit is designed to provide the learner with an understanding of the business aspects of their industry. It is applicable to all sectors of the environment and land-based sector and learners focus their study on the sector most relevant to their vocational interests.

In Outcome 1 they will investigate the size, scope and importance of their specialist sector within the environment and land-based industries, and how this has developed over the last 50 years or so. For some sectors this type of information is more readily available than other (e.g. agriculture), so learners should be supported in accessing whatever information is available relevant to their sector. They will also investigate the range of business types and other organisations that are represented in their sector, including important regulatory, professional or representative organisations. Wherever possible this should be related to specific businesses and organisations. This outcome is likely to require formal teaching, which should be supported by relevant information on businesses and organisations within the sector, and could include speakers representing these. Independent study and investigation should also be encouraged.

Outcome 2 focuses on the legal and resource implications of constituting a business. They will learn about the range of business organisations in the private and public sectors, and the legal and practical implications of different business types. This should be related to the types of business important in their sector. Learners will investigate the physical resource requirements of businesses, and how they are managed. It would be appropriate for learners to undertake a case study on a business premises in their sector and appraise its strengths and weaknesses for a given business use. The understanding that learners will gain on job roles and responsibilities has links with the requirements for Work Experience, and employers could be invited to explain their expectations in the workplace. The learners' investigations should focus on job roles within their specialist sector.

In Outcome 3 learners will analyse the market for a specific land-based business. This could involve a case study project and should identify, for that business, information on the content listed. External influences should be relevant and current to that business. Specific competitors should be identified and analysed to identify strengths and weaknesses to the case study business. When investigating the supply chain learners will need to identify the flow of resources from production of raw materials, through relevant manufacture and processing, to end consumers. Quality management will include reference to any formal standards or approvals that are relevant. It should also consider the quality standards required by the industry, any systems and practices that are used to achieve quality, and implications of failing to meet prescribed or assumed levels of quality. This should be related to specific businesses and teaching could again be supported by relevant visiting speakers from industry.

Outcome 4 focuses on the range of financial and physical records that are required to meet legal requirements as well as to ensure effective business operation. Learners will need to be able to complete simple examples of the range of financial records listed. They should be aware of paper-based and computerised systems for financial records but are not expected to become competent in the use of IT accounts software. The range of physical records investigated should be related to the needs of the learners' specialist sector, and should include important current examples of legally required records. This content could link with other specialist vocational units. In addition to completing a range of records, learners will investigate how specific examples can be used to aid decision making, monitor and control business performance.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

It is accepted that formal lectures will be necessary at level 3 but for this unit it is recommended that they are they are linked directly with interactive lessons in a real environment.

## **References**

### **Books**

Gillespie A. 2002. *Business in Action*. Hodder Arnold.

Jones R, Raffo C and Hall D. 2004. *Business Studies, 3rd Edition*. Causeway Press.

Nix J. 2009 *Farm Management Pocketbook*, 40th Revised edition. The Anderson Centre.

Warren M. 1997. *Financial Management for Farmers and Rural Managers*. Blackwell.

Lewis R & Trevitt, R. 2007. *BTEC National Business*. Nelson Thornes.

Dooley D, Dransfield R, Goymer J & Guy P. 2007. *BTEC National Business*. Heinemann.

## Unit 333

# Undertake an Investigative Project in the Land-based Sector

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of undertaking an investigative project and how this 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 learner will develop project knowledge and skills by investigating a chosen topic area through a project. They will explore topic areas that interest them and select one topic for their investigative project. They will plan and carry out their investigative project working to meet deadlines and monitoring performance. The learner will prepare an evaluative report looking at how the project performed, if the schedule plan met the project aims and objectives and how improvements could be made in the future.

### Learning outcomes

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

1. Be able to identify and research a suitable topic for an investigative project in the environmental and land-based sector
2. Be able to plan for an investigative project in the environmental and land-based sector
3. Be able to carry out an investigative project in the environmental and land-based sector
4. Be able to report on an investigative project in the environmental and land-based sector

### 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 333 Undertake an Investigative Project in the Land-based Sector**

**Outcome 1** Be able to identify and research a suitable topic for an investigative project in the environmental and land-based sector

### **Assessment Criteria**

The learner can:

1. List **information sources** relevant to the topic to be researched
2. Carry out **research** into potential topics
3. **Select and describe** a relevant investigative project topic in the environmental and land-based sector
4. **Prepare a proposal** for an investigative project

### **Range**

The topics for the investigative project should reflect both learner interest and the qualification undertaken.

### **Unit content**

#### **Information sources**

For example textbooks, journals, magazines, internet, trade literature, television and radio, subject experts, validity and reliability

#### **Research**

Methods appropriate to the project, e.g. literature review, trials, experiments, practical activities, questionnaires, interviews, surveys

#### **Select and describe**

Suitable project topic (e.g. trial or experiment, investigation of an issue important to the sector, preparation of a plan, production of a structure or artefact, training programme, preparation for and participation in a competition, improving a process, investigation of a new product or service). Justify the selection of the project topic in relation to e.g. programme of study, interests and experience, future employment ambitions, comparison with alternative topics

#### **Prepare a proposal**

Title, aims/ objectives, methodology, information sources, resources (e.g. people, computers, materials, etc. required for completion of the project), justification of proposed project

## Unit 333

## Undertake an Investigative Project in the Land-based Sector

### Outcome 2

Be able to plan for an investigative project in the environmental and land-based sector

#### Assessment Criteria

The learner can:

1. **Plan operations and resources** required to carry out a selected investigative project in the environmental and land-based sector
2. Explain the **reasons** for resources selected

#### Range

The topics for the investigative project should reflect both learner interest and the qualification undertaken.

#### Unit content

##### Plan operations

Project planning techniques (e.g. critical path analysis, Gantt charts), sequencing of activities, working to deadlines, allowing for other commitments, project action plan: aims, objectives, specific operations / tasks, start and completion dates, time required, resources required, possible disruptions to plan (e.g. illness, other commitments, resource problems, IT problems, research problems, lack of cooperation, cost), contingencies and remedial actions

##### Resources

People, time, buildings, equipment, animals, materials, literature and media (internet, trade magazine), IT applications and budget

##### Reasons

Suitability, availability and cost

## Unit 333

# Undertake an Investigative Project in the Land-based Sector

## Outcome 3

Be able to carry out an investigative project in the environmental and land-based sector

### Assessment Criteria

The learner can:

1. **Carry out a selected investigative project** in the environmental and land-based sector
2. **Monitor progress**, working to **deadlines**
3. Discuss the **health and safety implications** of the investigative project

### Range

The topics for the investigative project should reflect both learner interest and the qualification undertaken.

### Unit content

#### Carry out a selected investigative project

Suitable project as proposed in outcome 1 (trial or experiment, investigation of an issue important to the sector, preparation of a plan, production of a structure or artefact, training programme, preparation for and participation in a competition, improving a process, investigation of a new product or service). Implementation (set up, start), operations (tasks, duties), evidence of actions e.g. literature review, artefacts, plans, presentations, witness statements, photographs or videos

#### Monitor progress

Diary or log of actions, monitoring of performance against schedule plan e.g. daily, weekly, monthly progress, budget, other appropriate measures for each resource or task, reasons and remedial actions if falling behind schedule

#### Deadlines

Interim, key mileposts, final, all to be reviewed at regular intervals by tutor

#### Health and safety implications

Health and safety, risk assessment, Personal Protective Equipment (PPE), relevant regulations and legislation, animal welfare, codes of practice

## Unit 333

## Undertake an Investigative Project in the Land-based Sector

### Outcome 4

Be able to report on an investigative project in the environmental and land-based sector

#### Assessment Criteria

The learner can:

1. **Report** on a selected investigative project in the environmental and land-based sector
2. **Evaluate achievements and areas for improvement** of a selected investigative project

#### Range

The topics for the investigative project should reflect both learner interest and the qualification undertaken.

#### Unit content

##### Report

Report on the project selected and completed in outcomes 1-3. Written report format, oral report presentation, title, aims/objectives, review of existing literature/information, methodology, results/findings (with appropriate evidence, e.g. charts and graphs, diagrams, photographs), conclusions, Harvard referencing

##### Evaluate achievements

Conduct and management of the project, action plan, keeping to deadlines, problems and remedial actions, project results/findings, strengths and weaknesses

##### Areas for improvement

Planning, implementation, methodology, results/findings, report, topics for further investigation



## Unit 333

# Undertake an Investigative Project in the Land-based Sector

## Notes for guidance

This unit is designed to encourage and develop independent research skills in learners provides valuable skills development for all level 3 learners and especially those looking to progress onto Higher Education. The concept of the project is applicable across all of the vocational areas in the environmental and land-based sector, and learners should be guided and encouraged to select a project topic that is particularly relevant to their interests. This could integrate with other units in their programme of study. The emphasis of the unit should be on project management and working to deadlines, as well as producing a meaningful investigative project. Much of the work will be carried out independently by learners but they must have access to appropriate tutor guidance and support.

In Outcome 1, learners will need to identify a suitable topic for their investigative project. This should be relevant to their programme of study and have a particular interest for them, for example in relation to a special area of interest, experience or future employment of study ambitions. Ideal project topics could have a practical or theoretical focus, but all projects should include potential for research into existing literature and information sources as well as a practical investigation or application, so should be chosen in agreement with the tutor. Learners are likely to need guidance on suitable project topics and tutor support to ensure that selected topics are achievable in the timescale and with the resources available. The proposal should outline the aims and objectives, information sources, resource requirements, and the methodology by which the learner intends to complete the project, as well as their justification for topic selection. If appropriate to the investigation, a hypothesis should be included as part of the methodology.

In Outcome 2, learners will need to complete a detailed action plan for completion of the investigative project within the set timescale. This should include, as a minimum:

- a detailed breakdown of all actions from starting the project up to submission of the completed project report
- resources required at each stage (and reasons for their selection)
- time expected for completion and interim target completion dates.

They should also consider possible setbacks to their planned schedule and contingency plans to ensure timely completion of the project. Learners are likely to require guidance on project planning techniques and how to compile an appropriately detailed action plan. They could be provided with a suitable template.

In Outcome 3, learners will conduct and complete their investigative project, collecting supporting evidence as appropriate, for example literature review, artefacts, witness statements, photographs or videos, etc. Whilst doing this, they should maintain a log or diary of all actions, and regularly monitor their progress against their action plan. It would be appropriate for tutors to conduct progress reviews at key stages of the project. As part of conducting the project, learners should discuss any health and safety implications of their work to humans and, if appropriate, animals, and identify any relevant legislation or codes of practice. Risk assessments may contribute to evidence of this.

In Outcome 4, learners will produce a summary report of their project and the process of its completion. This should cover, as a minimum:

- title
- aims / objectives
- review of existing literature / information
- methodology
- results / findings
- conclusions
- references

All referencing should comply with academic conventions, and learners should be given appropriate guidance on this.

The project evaluation should consider the strengths and weaknesses of the finished project and the process of its completion, the usefulness and importance of project planning, and ways in which the project could have been improved.

Some parts of the project report could be presented orally rather than in written report format.

## **References**

### **Books**

- Applegarth, M. 1998. *The Project Management Pocketbook*. Alresford: Management Pocketbooks.
- Nokes, S., Kelly, S. 2007. *The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget*. 2<sup>nd</sup> ed. Harlow: Financial Times Prentice Hall.
- Portney, S.E. 2001. *Project Management for Dummies*. Sussex: Wiley Publishing.

**Level:** 3

**Credit value:** 5

**Unit aim**

This unit aims to introduce learners to the skills and knowledge in applications of science and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

**Learning outcomes**

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

1. Be able to apply scientific principles related to heat, force and machines to solve vehicle-related tasks
2. Be able to carry out engine testing and apply scientific principles related to vehicle and engine performance

**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 Land-based service engineering NOS.

**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 334

### Outcome 1

## Applications of Science in Land-based Engineering

Be able to apply scientific principles related to heat, force and machines to solve vehicle-related tasks

### Assessment Criteria

The learner can:

1. Use the **laws of friction** to find the friction in a clutch and determine **Young's modulus** for a given tension/compression on a given vehicle component
2. Use a **gas law** to determine the change in **dimensions** of the gas

### Unit content

#### Friction

Dry, lubricated, skin, fluid and internal

#### Laws of friction

Friction: the force that resists motion when the surface of one object slides over the surface of another. Frictional forces are always parallel to the surfaces in contact, and they oppose any motion or attempted motion. No movement will occur unless a force equal to or greater than the frictional force is applied to the body or bodies that can move

Three laws apply to frictional forces

First, the force of friction between an object and the surface on which it rests upon is proportional to the weight of the object

Second, (in most cases) the force of friction between an object and the surface on which it rests upon is independent of the surface area of the object and/or the surface

Third, the force of friction between an object and the surface on which it rests is independent of the speed at which the object moves—provided that the speed is not zero. This suggests that two types of friction exists, static and kinetic

#### Young's modulus

Describes the elastic properties of linear objects, e.g. wires, rods or columns that are stretched or compressed and is the ratio of the stress to the strain

#### Gas laws

Ideal Gas Law, Boyles Law, Charles law

#### Dimensions

Volume, pressure, temperature

## Unit 334

### Outcome 2

## Applications of Science in Land-based Engineering

Be able to carry out engine testing and apply scientific principles related to vehicle and engine performance

### Assessment Criteria

The learner can:

1. Describe how **ratios** help a given vehicle mechanism function properly
2. Calculate vehicle **performance** using **Newton's laws** and the equations of motion
3. Carry out **engine testing** to obtain data and **report** on engine performance

### Unit content

#### Ratio

Pulley, gear, mechanical ratio

#### Performance

Speed, power, torque

#### Newton's laws

Three laws of motion

#### Engine testing

Temperature, fuel use, power, torque & speed

#### Report

Verbal, written

# Unit 334 Applications of Science in Land-based Engineering

## Notes for guidance

This unit is designed to provide learners with the knowledge and understanding of how to use scientific principles to carry out engine testing and vehicle performance. Emphasis should be made to the application of these scientific principles in engineering operations.

Learners will need to have a sound knowledge of the scientific principles: Newton's Laws, Young Modulus, laws of friction and the gas laws. .

Delivery of this unit is likely to be largely classroom based with some practical sessions and activities. Learners should be given plenty of opportunity to practise carrying out test on engines performance and collecting data. 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 perform tests, collect their own data sets will be 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.

### References

#### Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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  
Manufacturers' publications and manuals

#### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

#### Websites

<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## Unit 335

# Undertake Retail Merchandising for the Land-based Sector

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of retail merchandising in the land-based sector 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. This unit has been specifically developed for 14-19 year old learners in full-time education acquiring additional knowledge of retailing.

The learner will develop their customer service skills. The learner will understand how items are effectively displayed, along with how they are promoted and marketed. They will consider the principles of stock control and storage.

### Learning outcomes

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

1. Be able to deliver effective customer service
2. Understand how to display items for sale
3. Understand methods of promotion and marketing
4. Understand the principles of ordering, pricing and controlling retail stock

### 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

Skillsmart Retail has approved this unit to be used within Edexcel BTEC and City & Guilds qualifications only

### Assessment and grading

This unit will be assessed by:

- An assignment covering practical skills and underpinning knowledge

## Unit 335

## Unit 335 Undertake Retail Merchandising for the Land-based Sector

### Outcome 1

Be able to deliver effective customer service

#### Assessment Criteria

The learner can:

1. Review the needs of different **customer groups**
2. Demonstrate effective **customer service skills**
3. Evaluate **customer service** in a given land-based outlet

#### Unit content

##### Customer groups

Individuals, businesses, customer classification e.g. age, sex, socio-economic group

##### Customer service skills

Effective communication (e.g. addressing customers face to face, appropriate telephone manner, effective written communication), courtesy, appropriate dress and body language, helpfulness, product knowledge

##### Customer service

Customer expectations, service standards, approach to customers, policies (e.g. refunds, complaints), after sales service, advice and assistance, compliance with Data Protection Act 1998



<b>Unit 335</b>	<b>Undertake Retail Merchandising for the Land-based Sector</b>
<b>Outcome 2</b>	<b>Understand how to display items for sale</b>

### Assessment Criteria

The learner can:

1. Analyse the **customer flow** and **space layout** of a given land-based outlet
2. Evaluate **display systems**
3. Discuss the influence of **legislation** on goods displayed

### Unit content

#### Customer flow

Direction of customer movements, clarity of store layout aiding customer flow, e.g. store plans, signage location and clarity, location of promotional offers

#### Space layout

Store design and plan including position of entrance and exit, location of tills, aisle widths, access for customers including those with disabilities

#### Display systems

Product groupings (e.g. by category of product, by species, according to perishability, seasonality, special promotions) types of display, location of displays

#### Legislation

Relevant legislation e.g. Sale of Goods Act 1968 (as amended 1979 & 1994), Trades Description Act 1968, Weights and Measures Act 1985, Consumer Protection Act 1987 (as amended 1994), Price Marking Order 2004

<b>Unit 335</b>	<b>Undertake Retail Merchandising for the Land-based Sector</b>
<b>Outcome 3</b>	<b>Understand methods of promotion and marketing</b>

### **Assessment Criteria**

The learner can:

1. Compare **methods of promotion**
2. Evaluate **marketing strategies** for given land-based outlets
3. Recommend **improvements** to a given marketing strategy

### **Unit content**

#### **Methods of promotion**

Advertising in different media, (e.g. radio, newspaper, internet, television), public relations and sponsorship, special offers and discounts, direct mailing

#### **Marketing strategies**

Strategies relating to the product (e.g. product design, product range, packaging), price, promotion (e.g. advertising, Public Relations and sponsorship, special offers and discounts, direct mailing), place (e.g. location, transportation, home delivery)

#### **Improvements**

Recommendations to support a given objective, e.g. increase market share, increase sales, increase customer base

<b>Unit 335</b>	<b>Undertake Retail Merchandising for the Land-based Sector</b>
<b>Outcome 4</b>	<b>Understand the principles of ordering, pricing and controlling retail stock</b>

### Assessment Criteria

The learner can:

1. Explain **buying** and ordering processes
2. Evaluate **stock control** and **storage methods**
3. Review **pricing methods**

### Unit content

#### Buying

Methods of payment, credit arrangements, methods of ordering, documentation, locating suppliers, stock delivery

#### Stock control

Stock rotation, planning to meet demand, monitoring stock

#### Storage methods

Perishable and non perishable items, security, storage of animal health products, minimising wastage, compliance with relevant legislation and guidelines, e.g. Veterinary Medicines Regulations 2009, DEFRA Code of Practice for Suitably Qualified Persons and Guidance for the Registration of Retail Premises 2008, Pet Animals Act 1951 (as amended in 1983)

#### Pricing methods

Cost based, competitor based and offers and discounts

## Unit 335

# Undertake Retail Merchandising for the Land-based Sector

## Notes for guidance

This unit is designed to provide learners with an understanding of the important skills for those working in and managing land-based retail outlets. Centres are encouraged to find a selection of appropriate outlets which could be used for comparison and case study material. Examples may include pet shops, farm retail shops, equine suppliers and shops selling pet care products, but could equally include other outlets such as a shop within a zoo, cattery or animal health charity.

As learners will be visiting other businesses and organisations, there should be an emphasis on safe working practices and appropriate risk assessments should be undertaken.

In Outcome 1, the focus is on customer service skills. It is anticipated that delivery of this unit will be through a mix of formal lectures, visits to appropriate outlets, and the opportunity to practise customer service skills in a real or simulated situation. Work placement in an appropriate setting would also help learners to develop effective customer service skills. It will be important to explore the potential impact of good and poor customer service on the business's current and future customers, and thus on the success of the business.

In Outcome 2, after appropriate classroom based activity, the learner will need access to land-based retail outlets to enable them to carry out the required analysis and evaluation of customer flow, space layout and display systems. It may be helpful to visit a larger outlet, possibly one that is part of a national chain, and a smaller independently owned one for comparison and to stimulate debate about the key factors. The study of relevant legislation may be assisted by considering case study examples of where this has been breached and the consequences of this to the business.

Outcome 3 requires learners to review promotional methods and marketing strategies for a selected land-based outlet. This could be the same outlet or a different one to those studied for outcomes 1 and 2. It may be helpful to study a larger outlet where there is often more evidence of formal strategies. The evaluation of and recommendation of improvements to, a marketing strategy should be carried out in the context of a specific business objective.

Outcome 4 could be delivered through more formal classroom based activity but it would be beneficial if this is supplemented with real work examples, through visits or guest speakers. It is important that learners develop an understanding of the different storage, legislative and security considerations for the varied types of stock which may be sold through a land-based outlet. Specific examples that are of relevance include animal health products, feedstuffs and in the case of a pet shop, live animals. This outcome also looks at buying, ordering and pricing methods and case study material would be useful to explore an appropriate range of methods.

At level 3 learners will have significant experience as customers of retail outlets. This perspective and experience will be helpful in developing their understanding of customer service and marketing methods in the land-based sector. It will be important that teaching and delivery focuses on the application of knowledge and skills to outlets in the land-based sector that are as relevant as possible to learners' interests.

## References

### Books

- Leland, K., Bailey, A. 2006. *Customer Service for Dummies*. Sussex: Wiley Publishing.
- Bradley, S., Hebron, L and Woods, A. 2001. *S/NVQ 3 Customer Service Candidate Handbook*. Oxford: Butterworth Heinemann.
- Ferrel, O.C. et al. 2005. *Marketing: Concepts and Strategies*. 5<sup>th</sup> ed. Geneva: Houghton Mifflin.
- Hall, D. et al. 2008. *Business studies*. 4th ed. St Albans: Causeway Press Ltd.
- Needham, D., Dransfield, R. 1994. *Business Studies Second Edition*. 2<sup>nd</sup> ed. Cheltenham: Nelson Thornes.

### Websites:

- |  |                                    |
|--|------------------------------------|
| <a href="http://www.bized.co.uk">www.bized.co.uk</a>                   | Business education website         |
| <a href="http://www.businesslink.gov.uk">www.businesslink.gov.uk</a>   | Business Link website              |
| <a href="http://www.marketingteacher.com">www.marketingteacher.com</a> | Marketing resources                |
| <a href="http://www.thetimes100.co.uk">www.thetimes100.co.uk</a>       | Case study materials and resources |

## Unit 336

# Undertaking Specialised Land-based Workshop Practices

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of specialised 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/higher education.

The learner will be introduced to the range of specialised workshop tools, equipment and materials as well as methods associated with new technology used in the land-based sector. They will learn the safe uses and function of these and how to undertake repair tasks. They will also consider correct care and storage of tools, equipment and materials in relation to manufacturer's recommendations and legislation.

### Learning outcomes

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

1. Be able to identify and select specialised tools, equipment and processes
2. Be able to use specialised tools and equipment in a safe and competent manner
3. Be able to carry out specialised maintenance and repair tasks.
4. Understand the need for correct care and storage of specialised tools, equipment and materials.

### 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 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 assignments covering practical skills and underpinning knowledge

## **Unit 336                      Understanding Specialist Land-based Workshop Practices**

**Outcome 1                      Be able to identify and select specialised tools, equipment and processes**

### **Assessment Criteria**

The learner can:

1. Identify and select appropriate **specialist tools, joining, cutting equipment, fasteners and finishes** for given situations
2. Describe the function of **specialist tools, joining, cutting equipment, fasteners and finishes**

### **Range**

All learning disciplines: the range of specialist tools and equipment to measure and carry out critical settings on machines and equipment, typical to the area of study, which involve a higher level of technology, technical strategies or techniques

### **Unit Content**

#### **Specialist tools**

Measuring aids feeler gauges, vernier callipers, fluid pressure measurement, heat measurement, torque wrench and amplifiers, multimeter, thread restorations, thread gauges, thread files, tap and die set

#### **Joining equipment**

Manual Metal Arc (MMA), Metal Inert Gas (MIG) and oxy fuel welding equipment, riveting, pop rivets, chemical adhesives, specialist fasteners, locking devices

#### **Cutting equipment, fasteners**

Oxy/fuel cutting and heating - power hacksaw, band saw, cutting/grinding discs

#### **Finishes**

Paint finish, oxides, ground coats, gloss and powder coating- plating/galvanise finish, bare metal protection

## Unit 336

## Understanding Specialist Land-based Workshop Practices

### Outcome 2

Be able to use specialised tools and equipment in a safe and competent manner

#### Assessment Criteria

The learner can:

1. **Safely use selected specialist tools, joining, cutting equipment, test equipment, fasteners and finishes** for given situations
2. Safely set up and **install replacement components** in selected specialist tools, joining and cutting equipment

#### Range

All learning disciplines- the range of specialist tools and equipment to measure and carry out critical settings on machines and equipment, typical to the area of study, which involve a higher level of technology, technical strategies or techniques

#### Unit content

##### Specialist tools

Measuring aids, feeler gauges, vernier callipers, fluid pressure measurement, heat measurement, torque wrench and amplifiers, multimeter, thread restorations, thread gauges, thread files, tap and die set

##### Joining equipment

Manual Metal Arc (MMA), Metal Inert Gas (MIG) and oxy fuel welding equipment, riveting, pop rivets, chemical adhesives, specialist fasteners, locking devices

##### Cutting equipment, fasteners

Oxy/fuel cutting and heating, power hacksaw, band saw, cutting/ grinding discs

##### Finishes

Paint finish, oxides, ground coats, gloss and powder coating- plating/galvanise finish, bare metal protection

##### Install replacement components

Tap and die selection, welding nozzle replacement, welding rod selection, hacksaw blade/band, selection replacement, speed and tension, grinding/cutting disc replacement, abrasive wheels regulations limitations.



## Unit 336

## Undertaking Specialist Land-based Workshop Practices

### Outcome 3

Be able to carry out specialised maintenance and repair tasks

#### Assessment Criteria

The learner can:

1. Using **manufacturers' guidance** safely carry out specialised **maintenance and repair tasks** on given land-based equipment
2. Identify the need for specialised **maintenance and repair tasks** on given land-based equipment

#### Range

All learning disciplines: the range of specialist tools and equipment to measure and carry out critical settings on machines and equipment, typical to the area of study, which involve a higher level of technology, technical strategies or techniques

#### Unit content

##### Manufacturers' guidance

Routine maintenance charts, operator instruction manuals, service manuals, data sheets, spare parts selection from lists/manuals/electronic/websites, manufacturers suggested limitations, warranties, dealer involvement

##### Maintenance tasks

Routine/scheduled or non-scheduled, replacement service parts identification procurement and replacement, wearing components, effective working limits, replacement, upgrade of component from original

##### Repair tasks

Bearing identification, selection, safe removal, replacement, use of pullers, expansion and contraction methods, initial lubrication, alignments- belts and pulley removal replacement, tensioning, alignment, speed changes, effect on torque- chain and sprocket maintenance, removal, replacement, manual and automatic tensioning, speed change, effect on torque, lubrication and non lubrication situations, joining links, welding/remanufacture/replacement options

## Unit 336

## Undertaking Specialist Land-based Workshop Practices

### Outcome 4

Understand the need for correct care and storage of specialised tools, equipment and materials.

#### Assessment Criteria

The learner can:

1. Explain the **care and storage** for selected specialist tools, equipment and materials
2. Discuss the importance of correct **care and storage** of selected specialist tools, equipment and materials.

#### Range

All learning disciplines: the range of specialist tools and equipment to measure and carry out critical settings on machines and equipment, typical to the area of study, which involve a higher level of technology, technical strategies or techniques

#### Unit content

##### Care and storage

Company procedures for authorised use, training/certification for use, records of use

Inspection of equipment, fit for purpose, calibration of measurement/readings

Careful handling, transit- maintenance of cutting/marking out tools cleaning sharpening pre storage, release of contained energy- return to storage, storage of materials, consumables – disposal of wastes, company policies, metals, waste lubricants, worn components, recycling, re-use

## Unit 336

# Undertaking Specialist Land-based Workshop Practice

## Notes for guidance

This unit is designed to provide learners from all land based areas of study to expand on basic maintenance techniques. It is expected that the learner will have prior knowledge and experience in the use of basic hand tools and execution of basic maintenance and repair tasks. With the ever increasing technological advances in the design of land-based machines and equipment more in depth knowledge and understanding coupled with more complex service tools and strategies is becoming the norm for maintaining efficiencies and longevity of equipment. The reliance on dealer servicing and simple repairs can disrupt, greatly, the operating costs and production profits hence the need for operators to service and repair to higher technological levels.

In Outcome 1, the learner will be required to choose, describe and evaluate specialist tools available to carry out servicing and repair tasks. Where a choice of strategies or specialist tools is made available, justification for choice must be addressed. When justifying strategy, an insight into repair costings is needed. Removal by destruction may be far more effective than timely perseverance on low cost items.

In Outcome 2, the learner is expected to demonstrate safe and efficient use of specialist tools and equipment in given situations. The situations should be related to the learners' area of study. Where data sheets or manufacturers' in the safe and correct use of specialist tools and equipment are available these must be used. If tools are subject to wear inefficiency or precision calibration malfunctions, systems to restore accuracy must be carried out.

In Outcome 3, the learner must demonstrate, in conjunction with correct use of basic tools, the procedures of specialist tool use. Machine/equipment manufacturers' guidelines must be followed wherever possible. Emphasis must be on safe working practices and health and safety issues must feature at all times. To be successful in this unit the learner must demonstrate the understanding and need for specialised maintenance on land-based machines and equipment.

In Outcome 4, the learner must be able to explain the procedures to be carried out to specialist tools and equipment prior to a return to storage and the reasons why this must be done. Where company reporting procedures have been put in place regarding losses, damage, reduced performance of specialist tools, this must be addressed as required.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

### References

#### Books

Bell, B. 1992. *Farm Workshop*. 2<sup>nd</sup> ed. Ipswich: Farming Press. ISBN 0852362374

Pearce, A. 2007. *Farm and Workshop Welding*. 2<sup>nd</sup> ed. Ipswich: Old Pond Publishing. ISBN 1905523300.

#### Website

[www.hse.gov.uk](http://www.hse.gov.uk) Health and Safety Executive

## Unit 337

## Refrigerant Handling

**Level:** 3

**Credit value:** 2

### Unit aim

This unit aims to provide learners with an understanding of handling refrigerants 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 handle refrigerants

**This unit must be delivered in conjunction with Level 3 Service and repair of land-based air conditioning/ climate control and refrigeration plant equipment (Unit 338, WBA reference F/601/5305).**

### Learning outcomes

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

1. Be able to handle refrigerants in accordance with legislation
2. Know how to handle refrigerants in accordance with legislation

### Guided learning hours

It is recommended that **12** 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 National Occupational Standard LEO28 Service and Repair Land-based Air Conditioning/Refrigeration 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 337

## Refrigerant Handling

### Outcome 1

Be able to handle refrigerants in accordance with legislation

#### Assessment Criteria

The learner can:

1. **Identify and locate** air conditioning systems and their components
2. Identify the **correct refrigerant types** and system capacities according to application
3. Use the appropriate tools and equipment to carry out refrigerant handling activities recovery
4. Follow **safety procedures** to collect and transfer any waste material in accordance with relevant legislation and policies
5. Maintain and **process appropriate records**

#### Range

##### Air conditioning systems

Mobile and fixed equipment

##### Components

Compressors and their drive line components, couplings, pipes and hoses, condenser, evaporator, receiver drier, thermostats, control and thermal expansion valves (TXV), fixed orifice tube (FOT) switches and sensors

##### Handling activities

Recovery, vacuum, flushing, recharging, leak detection, storage, recycling and disposal

#### Unit content

##### Identify and locate

System types used in land-based engineering applications, the systems components and their relationship with one another within the system

##### Correct refrigerant types

Types of refrigerants, their characteristics, applications and storage labelling requirements, where to access the data and information outlining system charge capacities and requirements

##### Safety procedures

Legislative procedures relating to refrigerant handling, for example know the environmental and health and safety risks associated with refrigerants and take appropriate actions in the event of leakages

##### Process appropriate records

Record keeping requirements, legislative requirements, importance of accuracy and legibility, storage and access of records

## Unit 337

## Refrigerant Handling

### Outcome 2

Know how to handle refrigerants in accordance with legislation

#### Assessment Criteria

The learner can:

1. Describe the **operating principles and function** of Mobile Air Conditioning (MAC) and fixed plant refrigeration systems and components
2. Describe **types of refrigerants** and their properties, characteristics and environmental impact
3. Describe how to **handle refrigerants** including recovery, testing (pressure or vacuum), flushing and recharging in Mobile Air Conditioning and fixed plant refrigeration systems
4. Describe how to work in a way which **minimises the risk** of any refrigerant emissions

#### Range

##### Air conditioning systems

Mobile and fixed equipment

##### Components

Compressors and their drive line components, couplings, pipes and hoses, condenser, evaporator, receiver drier, thermostats, control and thermal expansion valves (TXV), fixed orifice tube (FOT) switches and sensors

##### Handling activities

Recovery, vacuum, flushing, recharging, leak detection, storage, recycling and disposal

#### Unit content

##### Operating principles and function

Understands the different types of system their components as listed in the range notes, their function and operating principles

##### Types of refrigerant

Types of refrigerant: their designations, properties, characteristics and impact on health and the environment, sources of information regarding legislation on the use of refrigerant types

##### Handle refrigerants

Methods and techniques used to handle refrigerants

##### Minimise the risk

Risks of handling refrigerants , the procedures and best practices to apply to minimise the possibility of emissions occurring, use of risk assessments

## Unit 337 Refrigerant Handling

### Notes for guidance

**This unit must be delivered in conjunction with Level 3 Service and repair of land-based air conditioning/ climate control and refrigeration plant equipment (Unit 338, WBA reference F/601/5305).**

This unit is designed to provide the learner with the knowledge, understanding and skills required to handle refrigerants in accordance with EC and UK legislation.

At all times the use of safe working practices and compliance with current legislation must be reinforced. When learners are taking part in practical activity the equipment used for the handling of refrigerants must be of a type approved as fit for purpose and meet the requirements stipulated in the relevant regulations.

Delivery of Outcomes 1 and 2 is likely to be closely linked, with Outcome 2 providing the underpinning knowledge and Outcome 1 the opportunity to apply it in practice.

Delivery of Outcome 1 is likely to have a practical bias, including demonstrations and supervised practical activity. Learners need sufficient practical time to carry out a range of refrigerant handling activities. It is particularly important that safety procedures are closely followed, and that learners understand the importance of these. Learners also need to maintain and process records, and the importance of accuracy should be stressed.

For Outcome 2, delivery is likely to include classroom based activities, independent learner research and visits to see a range of mobile air conditioning and fixed plant refrigeration systems. Learners need to gain an understanding of the operating principles and functions, and be able to compare the different types of refrigerant and how to handle them.

## Unit 338

# Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment

**Level:** 3

**Credit value:** 3

### Unit aim

This unit aims to provide learners with an understanding of the construction, function and operation of air conditioning/ climate control and refrigeration 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 service and repair land based air conditioning, climate control and refrigeration plant and equipment

**This unit must be delivered in conjunction with Level 3 Refrigerant Handling (Unit 337, WBA reference L/601/5310).**

### Learning outcomes

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

1. Be able to perform air conditioning, climate control and refrigeration service and maintenance operations
2. Understand the construction, function and operation of air conditioning, climate control and refrigeration systems and their components

### Guided learning hours

It is recommended that **18** 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 National Occupational Standard LEO28 Service and Repair Land-based Air Conditioning/Refrigeration 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 338**                    **Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment**

**Outcome 1**                    Be able to perform air conditioning, climate control and refrigeration service and maintenance operations

### **Assessment Criteria**

The learner can:

1. **Remove, dismantle**, inspect, **repair and reinstate** systems and/or components
2. Select and use appropriate tools and equipment to carry out **testing and maintenance activities** to manufacturer's specification and standards
3. Diagnose and rectify different **faults**
4. **Collect, transfer and dispose** of any waste material following current legal and environmental requirements
5. **Maintain appropriate records**

### **Range**

#### **Systems**

Mobile and fixed equipment

#### **Components**

Compressors and their drive line components, couplings, pipes and hoses, condenser, evaporator, receiver drier, thermostats, control and thermal expansion valves (TXV), fixed orifice tube (FOT) switches and sensors

#### **Service and maintenance operations**

Pressure testing, leak testing, vacuum testing, gas recovery, system flushing, recharging, performance testing and maintenance

### **Unit content**

#### **Remove, dismantle, repair and reinstate**

Can remove dismantle repair and reinstate to manufacturers specifications, systems and components as listed in the range notes, whilst complying with safety and legislative requirements and industry best practices

#### **Testing and maintenance activities**

Leak testing, pressure testing, vacuum testing, gas recovery, system flushing, recharging, performance testing

Carry out operational checks and/or tests to establish system functionality

#### **Faults**

Compressor failure, compressor drive line failure, refrigerant loss, restricted refrigerant flow, restricted air flow, faulty switches, faulty sensors, faulty temperature controls, under charge of refrigerant, overcharge of refrigerant, incorrect lubricant levels, system contamination, corrosion

#### **Collect transfer and dispose**

Drain, collect, transfer and dispose of waste material removed (for example refrigerants, lubrication, replaced parts) in line with environmental and legislative requirements

**Maintain appropriate records**

Can follow and apply the best practices to comply with legislative requirements regarding the recording and documenting of refrigerant handling

## Unit 338 Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment

Outcome 2 Understand the construction, function and operation of air conditioning, climate control and refrigeration systems and their components

### Assessment Criteria

The learner can:

1. Describe the **types, construction, function** and operating principles of air conditioning, climate control and refrigeration systems and their components
2. Explain how to carry out **operational checks** and **diagnostic tests** to establish system functionality
3. Describe how to **recognise and rectify faults**
4. Describe how to **collect, transfer, dispose** of any waste material following current legal and environmental requirements
5. Summarise the **procedures, tools and equipment** to remove dismantle, inspect and reinstate air conditioning and refrigeration components
6. Explain what relevant **documentation** should be used when handling refrigerants

### Range

#### Systems

Mobile and fixed equipment

#### Components

Compressors and their drive line components, couplings, pipes and hoses, condenser, evaporator, receiver drier, thermostats, control and thermal expansion valves (TXV), fixed orifice tube (FOT) switches and sensors

#### Service and maintenance operations

Pressure testing, leak testing, vacuum testing, gas recovery, system flushing, recharging, performance testing and maintenance

### Unit content

#### Types, construction and function

Types: compressors and their drives, couplings, pipes and hoses

Construction: control and thermal expansion valves (TXV), fixed orifice tube (FOT)

Function: condenser, evaporator, receiver drier, thermostats

#### Operational checks

Checks on compressor drives, switches and controls, cooling rate and effectiveness, checking for condensation and icing, air flow and icing, filter inspections

#### Diagnostic tests

Compressor drive, switches and controls, cooling rate/effectiveness, condensation and or icing, insulation, air flow, filter inspection

**Faults**

Compressor failure, compressor drive line failure, refrigerant loss, restricted refrigerant flow, restricted air flow, faulty switches, faulty sensors, faulty temperature controls, under charge of refrigerant, overcharge of refrigerant, incorrect lubricant levels, system contamination, corrosion, fault recognition, how to rectify faults in line with manufacturer's specifications and legislative requirements

**Collect transfer and dispose**

Methods to collect transfer and dispose of refrigerants and waste materials, the administration documentation and procedures used to comply with industry best practice, environmental and legislative requirements

**Evaluate test results**

Compare test and inspection data with manufacturer's specifications, draw conclusions on which to justify rectification and repair recommendations

**Procedures tools and equipment**

Select and use the appropriate tools and equipment to include all of the following: maintenance, leak testing, recovery, flushing, recharging, performance testing, pressure testing, vacuum testing

**Documentation**

Documentation required when handling refrigerants, why it is necessary and how to complete and file for future reference, maintaining records

## **Unit 338                      Service and Repair of Land-based Air Conditioning, Climate Control and Refrigeration Plant and Equipment**

### Notes for guidance

**This unit must be delivered in conjunction with Level 3 Refrigerant handling (Unit 337, WBA reference L/601/5310).**

This unit is designed to provide the learner with the knowledge, understanding and skills required to service and repair land based air conditioning, climate control and refrigeration plant and equipment.

At all times the use of safe working practices and compliance with current legislation must be reinforced.

When delivering this unit it is understood that for reasons of resource learners may have to carry out manual assessment activities on mobile air conditioning / climate control systems rather than fixed refrigeration and climate control systems. Formal instruction content should, however, cover both mobile and fixed equipment.

Delivery of Outcomes 1 and 2 is likely to be closely linked, with Outcome 2 providing the underpinning knowledge and Outcome 1 the opportunity to apply it in practice.

Delivery of Outcome 1 is likely to have a practical bias, including demonstrations and supervised practical activity. Learners need sufficient practical time to carry out a range of servicing activities, including fault diagnosis and rectification and correct methods of waste disposal. It is particularly important that safety procedures are closely followed, and that learners understand the importance of these. Learners also need to maintain and process records, and the importance of accuracy should be stressed.

For Outcome 2, delivery is likely to include classroom based activities, independent learner research and visits to see a range of mobile air conditioning and fixed plant refrigeration systems. Learners need to gain an understanding of the types of unit and their operating principles and functions, how to carry out checks and diagnostic tests, and how to evaluate test results. It will be helpful if delivery of this outcome is closely linked to the practical activities in Outcome 1.

## Unit 339

# Recognise and Reduce Risks in the Land-based Engineering Work Area

**Level:** 3

**Credit value:** 5

### Unit aim

The aim and purpose of this unit is to provide the learner with the knowledge and skills and understanding to recognise and reduce risks within a land based engineering work environment.

### Learning outcomes

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

5. Be able to recognise and reduce risks in the land-based engineering work area
6. Understand how to recognise and reduce risk within the land-based engineering work area

### 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 NOS unit Land-based Engineering Operations LE01.

### Endorsement of the unit by a sector or other appropriate body

This unit is endorsed by Lantra Sector Skills Council (SSC).

### Assessment and grading

This unit will be assessed by:

- an assignment covering practical skills and underpinning knowledge.

## **Unit 339                    Recognise and Reduce Risks in the Land-based Engineering Work Area**

**Outcome 1                Be able to recognise and reduce risks in the land-based engineering work area**

### **Assessment Criteria**

The learner can:

1. Identify and evaluate **health and safety and environmental hazards** and their associated risks in the work area in line with best practice
2. Assess the effects of attitude, knowledge and experience upon **perception of risk in the workplace**
3. Define the term '**so far as is reasonably practicable**'
4. Carry out a **risk assessment**

### **Unit content**

#### **Health and safety and environmental hazards**

Effectiveness of measures, individuals at risk, fatal, non-fatal accidents: occupational asthma, dermatitis, zoonoses, noise, muscular skeletal disorders. Slips trips and falls, contact with machinery, struck by moving object, contact with electricity, machinery collapsing /overturning, use of flammable liquids and gases, waste disposal, contaminated waste, sources of pollution, pollution control

#### **Perception of risk in the workplace**

Age, gender, race, routine activities, one off activity, employees' attitude, employers' attitude, staff training

#### **'So far as is reasonably practicable'**

Weighing a risk against the trouble, time and money needed to control it, HSE guidance, regulations, Approved codes of practice (ACoPs), Health and Safety at Work Act etc 1974

#### **Risk assessment**

Specific to task, hazards, persons at risk, control measures, legal requirements, reviewing and monitoring



## **Unit 339                    Recognise and Reduce Risks in the Land-based Engineering Work Area**

**Outcome 2                    Understand how to recognise and reduce risk within the land-based engineering work area**

### **Assessment Criteria**

The learner can:

1. Describe activities in the workplace that give rise to **significant risks to health and safety and the environment**
2. Explain why certain **individuals or groups may be at an increased level of risk** and how this can be addressed
3. Explain the **hierarchy of risk control** measures
4. Summarise the **legislative requirements regulating health and safety and environmental risk assessments**

### **Unit content**

#### **Significant risks to health and safety and the environment**

Workplace environment, work practices, slips, trips, falls, falling objects, entrapment, asphyxiation/inhalation, noise levels, physical limitations, hazardous materials, fire and/or explosion, exposure times, ventilation and extraction, PPE, lone working, atmospheric contamination, soil contamination, water course contamination, leakages, spills, storage and disposal, chemicals (mixing, storage, dilution, neutralisation, environmentally friendly materials)

#### **Individuals or groups may be at an increased level of risk**

Attitude, age, race, gender, knowledge, experience, perception of risk

#### **Hierarchy of risk control**

Five steps to risk assessment (Identify the hazards, who might be harmed and how, evaluate the risks and decide on precautions, record your findings and implement them, review your assessment and update if necessary)

#### **Legislative requirements regulating health and safety and environmental risk assessments**

Employer notification, employee notification, HSE notification, Environmental Protection Act 1990, chemical legislation, air legislation, energy legislation, waste legislation, water legislation, Health and Safety at Work Act etc 1974, Control of Substances Hazardous to Health (COSHH)

## Unit 339

# Recognise and Reduce Risks in the Land-based Engineering Work Area

## Notes for guidance

This unit is designed to give the learners the necessary knowledge and skills to be able to recognise and reduce risks 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 throughout this unit.

Outcome 1 enables the learner to be able to recognise risks in the workplace, and what measures can be put in place to reduce these risks. It also enables the student to complete a risk assessment, and consider perceptions of colleagues in the work, and understand what the meaning 'so far as reasonably practicable' means. The delivery of this outcome is largely classroom based however the learners may benefit from site visits, industry visitors and case studies.

Outcome 2 will enable the learner to understand the activities which cause risks to occur in the workplace so that preventative measures can be taken before such a risk occurs. The learner will gain a greater knowledge of the legislative understanding of risk assessments and why risk assessments are carried out. The learner will also be able to understand why legislation plays such a large part of reducing risks in the workplace. Outcome 2 is again largely classroom based however learners will benefit from site visits and forum talks from industry representatives.

### 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

Safe use of work equipment: Provision and use of work equipment regulations 1998. Approved Code of Practice and guidance. HSE Books. ISBN 0717616266

Safe use of lifting equipment: lifting operations and lifting equipment regulations 1998: Approved code of practice and guidance. HSE Books. ISBN 0717616282

HSE: 5 steps to Risk assessment. HSE leaflets INDG163(rev2)

Control of substances hazardous to health. The control of substances hazardous to health regulations 2002. Approved code of practice and guidance (fourth edition) 2002. HSE Books. ISBN 0717625346

#### Journals

Profi International

Farmers Weekly

Farm Ideas

#### Websites

[www.hse.gov.uk](http://www.hse.gov.uk)

Health and Safety Executive

## Unit 340

# Land-based Engineering Operations – Perform Thermal Joining Processes

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of thermal joining techniques 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 safely carry out thermal joining processes

### Pre-requisites

Learners must achieve unit 208 Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes before achieving this unit. This can be done either as part of the Level 2 Certificate, Extended Certificate or Diploma in Land-based Machinery or as a unit within the level 3 qualification.

### Learning outcomes

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

1. Be able to perform thermal joining
2. Understand high temperature thermal joining 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 340**                      **Land-based Engineering Operations – Perform Thermal Joining Processes**

Outcome 1                      Be able to perform thermal joining

### **Assessment Criteria**

The learner can:

1. **Prepare the workplace and equipment** to carry out a thermal joining process
2. Set up equipment and carry out preparation of material for **positional welding techniques**
3. **Join or repair a range of materials** producing joints
4. **Identify faults** using appropriate inspection techniques

### **Range**

#### **Welding plant types**

MIG/ MAG, TIG, MMA, Oxycetaline

#### **Consumables**

Shield gas, wire and electrodes, contactor tip

#### **Welding hazards**

Fumes, explosions, heat and fire sharp edges, airborne particles, personal injury

### **Unit contents**

#### **Prepare the workplace and equipment**

Work area preparation, to include risk assessment of the welding activity, equipment inspection including Personal Protective Equipment (PPE) to ensure it is suitable, safe and serviceable, welding plant maintenance to ensure compliance with manufacturer's specifications, replace consumables and wearing parts, safe start up and shut down procedures

#### **Positional welding techniques**

Set up equipment to perform a welding task, prepare materials for joining, repair or refurbishment, use and application of methods to position materials for example clamping, tacking, positioning, bevelling, set equipment and position materials to produce horizontal, vertical and overhead welds

#### **Join or repair a range of materials**

Produce welds and weld repairs to a predetermined quality and dimension using a range of materials to include cast iron, alloys, low carbon steel and dissimilar metals types and sizes

#### **Identify faults**

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

## **Unit 340**                      **Land-based Engineering Operations – Perform Thermal Joining Processes**

**Outcome 2**                      Understand high temperature thermal joining techniques

### **Assessment Criteria**

The learner can:

1. Explain the different **techniques** used to carry out positional thermal joining procedures
2. Explain how to **prepare and set up MIG/MAG, TIG, MMA welding equipment** for positional welding tasks
3. **Explain how to use thermal joining techniques** to join and repair
4. Explain the **safety preparations and precautions** required to minimise risk prior to and during thermal joining and repair processes

### **Range**

#### **Welding plant types**

MIG/ MAG, TIG, MMA, Oxycetaline

#### **Consumables**

Shield gas, wire and electrodes, contactor tip

#### **Welding hazards**

Fumes, explosions, heat and fire sharp edges, airborne particles, personal injury

### **Unit content**

#### **Techniques**

Know the different techniques, their advantages and applications when carrying out positional thermal joining and the corresponding settings required for these techniques

#### **Prepare and set up MIG/MAG, TIG, MMA welding equipment**

Understand the function of the welding plant, its components and operation, know how to interpret the manufacturer's handbook and setting information for different welding tasks, understand how to perform settings and maintenance activities and identify consumables

#### **Explain how to use thermal welding techniques**

Know the thermal joining techniques their applications and advantages when carrying out positional thermal joining or repairs on a range of material to include cast iron, alloys and dissimilar metals

#### **Safety preparations and precautions**

Preparations: seals, filters, contamination, distortion, stress relief, fire and fume hazards, electrical/electronic components and systems, ancillary equipment

Precautions: to prevent or reduce the effects of fumes, explosions, heat/fire, sharp edges, airborne debris, personal injury



## Unit 340 Land-based Engineering Operations – Perform Thermal Joining Processes

### Notes for guidance

**This unit does not cover the repair of safety critical components.**

This unit is mainly practical and designed to provide candidates with the knowledge and skills to carry out MIG/MAG, TIG, MMA and oxyacetylene thermal joining and repair processes using positional techniques. During the delivery of this unit learners will be expected to work within the relevant industrial standards.

Learners will develop theoretical and practical skills in safe working practices associated with thermal joining including the use shield gases.

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. 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.

In Outcome 1, delivery is likely to include significant practical activity in an appropriately equipped workshop. It is particularly important, given the nature of the potential safety hazards in this unit, that learners use appropriate PPE, and that instruction and supervision takes place in small groups. Learners need to develop their practical skills in using a range of welding techniques for a range of materials. This includes the preparation of the workplace and equipment, setting up equipment and preparing materials. Delivery also needs to include fault identification, and the inspection techniques that may be used.

It would be beneficial if the underpinning knowledge and understanding in Outcome 2 is delivered either before or in conjunction with delivery of Outcome 1.

In Outcome 2, learners will gain an understanding of a range of welding techniques, and how these may be used to join and repair different materials. Delivery also needs to include the correct procedures for setting up welding equipment, and the safety preparations and precautions that are necessary to minimise risk during practical activities. Delivery is likely to include classroom based activities, supported by practical demonstrations, which may include peer observations.

## References

### Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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 and Repair Series: Level 3), 3rd Edition* (Thomson Learning, 2001) ISBN 186152806X  
Manufacturers publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers



## Unit 341

# Participate in Business Planning and Improvement in the Land-based Sector

**Level:** 3

**Credit value:** 10

### Unit aim

This unit aims to provide learners with an understanding of the principles of business planning and improvement in the land-based industries 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 learner will explore business improvement, including opportunities for diversification, how it can give a competitive advantage and reduce environmental impact. They will learn the skills necessary for developing a business idea, and preparing a business plan.

### Learning outcomes

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

1. Understand business improvement in land-based industries
2. Be able to identify and plan opportunities for practical business improvement
3. Be able to develop a land-based business idea
4. Be able to prepare a business plan

### 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 341                      Participate in Business Planning and Improvement in the Land-based Sector**

**Outcome 1                      Understand business improvement in land-based industries**

### **Assessment Criteria**

The learner can:

1. Describe **strategies** that a land-based business can adopt to **improve performance**
2. Describe ways that a land-based business can achieve **competitive advantage**
3. Describe how a land-based business can improve its **environmental impact**

### **Unit content**

#### **Strategies**

Consolidation, expand market share, product development, market development, diversification, (opportunities and risks) and Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis

#### **Improve performance**

Improved effectiveness and efficiency in key business functional areas, e.g. products, services, marketing, customer relations, staffing, staff management, working practices, production efficiency, financing, financial control, internal factors impacting on business performance (e.g. resources and management), external factors impacting on performance (e.g. political, economic, socio-cultural and technological)

#### **Competitive advantage**

Price, differentiation (e.g. quality, location, customer service and perceived added value), use of marketing mix (product, price, place and promotion)

#### **Environmental impact**

Resource use, waste, recycling, pollution (chemical, biological, visual, audible, light), road traffic, carbon footprint, enhancement of the environment (e.g. preservation or creation of habitats, conservation of structures), principles of sustainability, relevant environmental legislation (e.g. Wildlife and Countryside Act 1981 (as amended 1991), Environmental Protection Act 1990 (as amended 1995), Control of Substances Hazardous to Health (COSHH) 2002, The Control of Pollution Regulations (Oil Storage) (England) Regulations 2001, Water Framework Directive (WFD), Cross Compliance, Nitrates Directive, Waste Management (England and Wales) Regulations 2006

## **Unit 341                      Participate in Business Planning and Improvement in the Land-based Sector**

**Outcome 2                      Be able to identify and plan opportunities for practical business improvement**

### **Assessment Criteria**

The learner can:

1. Identify **potential improvements** in a business within a land-based context
2. Prepare a **plan for achieving business improvements** or **diversification** within a land-based context

### **Unit content**

#### **Potential improvements**

Improvements in key business functional areas, e.g. products, services, marketing, customer relations, staffing, staff management, working practices, production efficiency, financing, financial control, importance of continuous improvement

#### **Plan for achieving business improvements**

Specific actions, rationale, timescale, resource implications, financial implications (costs, likely returns), key factors for success and risks

#### **Diversification**

Opportunities for diversification (e.g. forward, backward, horizontal), related, unrelated, evaluation of opportunities in relation to resources, skills and finance needed

## **Unit 341                    Participate in Business Planning and Improvement in the Land-based Sector**

**Outcome 3                    Be able to develop a land-based business idea**

### **Assessment Criteria**

The learner can:

1. Develop a land-based **business idea**
2. **Research the market** for a land-based business idea

### **Unit content**

#### **Business idea**

Establishment of a new business, diversification or development of new enterprise and implement improvements to an existing business

#### **Research the market**

Market analysis (size, trends, competition, segmentation, target market), primary and secondary research

## **Unit 341                      Participate in Business Planning and Improvement in the Land-based Sector**

Outcome 4                      Be able to prepare a business plan

### **Assessment Criteria**

The learner can:

1. Produce a **business plan** to meet given specifications
2. **Present** a land-based business plan

### **Unit content**

#### **Business plan**

Purposes of the business plan, business products or services, aims and objectives, market analysis (size, trends, competition, segmentation, target market), physical resources (e.g. property, machinery, vehicles, equipment and stock), human resources (staffing structure, management and key personnel, job descriptions and person specifications), promotion (media and cost), financial forecasts (setting up costs, pricing, income, costs, profit and monthly cash flow forecast), finance needs, sources of finance (equity, borrowing and grants), legal issues e.g. legal status (sole trader, partnership, company, franchise and co-operative), trading terms and conditions, trading standards, licences, relevant current legislation, planning permission, health and safety, fire regulations, regulatory bodies, sources of advice (solicitor, accountant)

#### **Present**

Different audiences (e.g. bank, investors and business management), written report format, oral presentation

# Unit 341 Participate in Business Planning and Improvement in the Land-based Sector

## Notes for guidance

This unit allows learners to explore the importance of improvement and planning for future business development. It should be related to the types of business relevant to the learners' vocational area and can include all forms of business, including not-for-profit organisations, not just commercial private sector businesses.

In Outcome 1, learners will investigate how business improvement should be sought in all of the key functional areas. They will discover that a sound business strategy derives from an understanding of current strengths, weaknesses, opportunities and threats and provides a focus for future improvements and development. They will also learn about the importance of sustainability and the need for businesses to reduce their environmental impact. The use of case studies and business visits would enhance the learning about these issues.

Outcome 2 progresses from the learning about business improvement in Outcome 1. Learners will identify specific improvements that could be made in a selected business from some of the key functional areas listed. These improvements could involve opportunities for business diversification, but learners should be cautioned that diversification is often a high risk strategy and opportunities need to be carefully evaluated. They will need to prepare a detailed plan for implementation of proposed improvements.

Outcomes 3 and 4 include a broad range of content and delivery of the module should allow for this. In Outcome 3 learners need to propose a land-based business development. This could be based on business improvements or developments identified in Outcome 2, a diversification proposal or for a new business start-up.

In Outcome 4, learners need to prepare a business plan for the business idea developed in Outcome 3. The completed business plan should be addressed to a specific audience and include business products or services, aims and objectives, market analysis, physical resources, human resources, promotion, financial forecasts, finance needs, sources of finance, legal issues. It would help learners if they can be provided with a suitable template for construction of the business plan.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

### References

#### Books

- Gillespie, A. 2002. *Business in Action* Hodder Arnold,  
Jones, R. Raffo, C. and Hall, D. 2004. *Business Studies*, 3rd Edition Causeway Press  
Nix, J. Farm Management Pocketbook  
Warren, M. 1997. *Financial Management for Farmers and Rural Managers* Blackwell  
Lewis, R. & Trevitt, R. 1997. *BTEC National Business* Nelson Thornes  
Dooley, D. Dransfield, R. 2007 Goymer, J. & Guy, P. *BTEC National Business* Heinemann  
Barrow, C. Tiffany P & Peterson S 2004 *Business Plans for Dummies* (John Wiley & Sons)  
Finch, B. 2006. *How to Write a Business Plan* Kogan Page

## 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 **customers' 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 the importance of meeting **customers' expectations**
4. Describe how to **recognise different behaviours** in customers
5. State **the limits of your authority and responsibility** when dealing with customers.
6. 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.

## References

### Books

- Brown, A. 1998. 1998. *Organisational Culture*. 2<sup>nd</sup> ed. New Jersey: Prentice Hall.
- Campbell, D., Craig, T. 2005. *Organisations and the Business Environment*. 2<sup>nd</sup> ed. Oxford: Butterworth Heinemann.
- Cook, S. 2008. *Customer Care Excellence: How to Create an Excellent Customer Focus*. London: Kogan Page Ltd.
- Mullins, L.J. 2008. *Essentials of Organisational Behaviour*. 2<sup>nd</sup> ed. New Jersey: Prentice Hall.
- Parks, S. 2005. *Small Business Handbook*. New Jersey: Prentice Hall.
- Stokes, D., Wilson, N. 2006. *Small Business Management and Entrepreneurship*. 5<sup>th</sup> ed. Andover: Thomson Learning.

### Journals

Customer Service Journal  
Customer Service in Marketing and Management  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers
<a href="http://www.bized.co.uk">www.bized.co.uk</a>	Business Education

## 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

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) equipment 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

<b>Unit 208</b>	<b>Land-based Engineering Operations – Perform Thermal Joining and Cutting Processes</b>
Outcome 2	Know how to perform thermal joining and cutting techniques

### Assessment Criteria

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, oxidisation 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 candidates 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.

## 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**

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**

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 **reinstate 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.

**Reinstate 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.

## References

### Books

- Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682
- Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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
- Manufacturer's publications and manuals

### Journals

Farmers Guardian  
Profi International  
Farmers Weekly

### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	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

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

1. Identify the **units of measurement** used to express values
2. State how to **use conversion tables**
3. Define the **mathematical formulas** 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.

### References

#### Books

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682  
Culpin C. 1992. *Farm Machinery, 12<sup>th</sup> 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  
Manufacturer's publications and manuals

#### Journals

Farmers Guardian  
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Farmers Weekly

#### Websites

<a href="http://www.bagma.com">www.bagma.com</a>	British Agricultural and Garden Machinery Association
<a href="http://www.defra.gov.uk">www.defra.gov.uk</a>	Dept for Environment, Food and Rural Affairs
<a href="http://www.wales.gov.uk">www.wales.gov.uk</a>	Welsh Assembly Government
<a href="http://www.scotland.gov.uk">www.scotland.gov.uk</a>	Scottish Executive Environment and Rural Affairs Department
<a href="http://www.dardni.gov.uk">www.dardni.gov.uk</a>	Department of Agriculture and Rural Affairs (Northern Ireland)
<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>	Health and Safety Executive
<a href="http://www.howstuffworks.com">www.howstuffworks.com</a>	How Stuff Works
<a href="http://www.iagre.org">www.iagre.org</a>	Institution of Agricultural Engineers

## 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](http://www.cityandguilds.com/functionalskills)
- Essential Skills (Northern Ireland) – see [www.cityandguilds.com/essentialskillsni](http://www.cityandguilds.com/essentialskillsni)
- Essential Skills Wales - [www.cityandguilds.com/esw](http://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](http://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 candidates
- 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 candidates 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 candidates 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
- ***Online assessment***  
Contains information on how to register for GOLLA assessments.

## Useful contacts

Type	Contact	Query
UK learners	T: +44 (0)84 4543 0033 E: learnersupport@cityandguilds.com	<ul style="list-style-type: none"> <li>• General qualification information</li> </ul>
Centres	T: +44 (0)84 4543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com	<ul style="list-style-type: none"> <li>• Exam entries</li> <li>• Registrations/enrolment</li> <li>• Certificates</li> <li>• Invoices</li> <li>• Missing or late exam materials</li> <li>• Nominal roll reports</li> <li>• Results</li> </ul>
Walled Garden	T: +44 (0)84 4543 0000 F: +44 (0)20 7294 2405 E: walledgarden@cityandguilds.com	<ul style="list-style-type: none"> <li>• Re-issue of password or username</li> <li>• Technical problems</li> <li>• Entries</li> <li>• Results</li> <li>• GOLA</li> <li>• Navigation</li> <li>• User/menu option problems</li> </ul>
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