



City & Guilds Level 2 Technical Certificate in Land-Based Engineering (0171-28)

September 2023 Version 2.2

(For delivery from September 2023)

Qualification Handbook

Qualification at a glance

Industry area	Land – Land-based engineering
City & Guilds qualification number	0171-28
Age group	16-19 (Key Stage 5), 19+
Entry requirements	Centres must ensure that any pre-requisites stated in the <i>What is this qualification about?</i> section are met.
Assessment	To gain this qualification, candidates must successfully achieve the following assessments: <ul style="list-style-type: none"> • Two externally set, externally marked exams, sat under examination conditions • One externally set, internally marked, externally moderated assignment
Additional requirements to gain this qualification	Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.
Grading	This qualification is graded Pass/Merit/Distinction/Distinction* For more information on grading, please see Section 7: Grading.
Approvals	These qualifications require full centre and qualification approval
Support materials	Sample assessments Guidance for delivery Guidance on use of marking grids
Registration and certification	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.
External quality assurance	This qualification is externally quality assured by City & Guilds, and its internally marked synoptic assignments are subject to external moderation. There is no direct claim status available for this qualification.

Title and level	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
City & Guilds Level 2 Technical Certificate in Land-Based Engineering	360	600	0171-28	603/0145/4

Version and date	Change detail	Section
1.1 May 2017	Updating assessment component numbers	1. Introduction 5. Assessment 7. Grading
1.2 August 2017	Synoptic assessment description contextualised	5. Assessment
	Addition of the examination paper based module number	1. Introduction – Assessment requirements and employer involvement 5. Assessment 5. Assessment – exam Specification 7. Grading – Awarding grades and reporting results
	Removal of AO 6-8 from Synoptic Assignments	5. Assessment – Assessment Objectives
	Addition of Provisional Grade Boundaries for the Synoptic Assignment	7. Grading
	Revised Exam Specification, Exam Duration and AO weightings	5. Assessment – Exam Specification
	Branding Changes	Throughout
	Unit 201 Aim updated	Unit
1.3 September 2017	Unit 201 title amended	Throughout
1.4 October 2017	Assessment type for unit 201 changed to assignment	1. Introduction 5. Assessment
1.5 December 2017	Amendment to summary of assessment methods and conditions table	5. Assessment
1.6 February 2018	Changes made to CCEA review – Additional guidance added and unit topic content updated	1. Introduction 3. Delivering technical qualifications Units 201 / 208 / 214
1.7 August 2018	City & Guilds added to the title	Throughout
1.8 September 2018	Amendment to summary of assessment methods and conditions table – Assessment 201	Assessment
1.9 October 2018	Added assessment method for unit 201	1. Introduction – Assessment requirements and employer involvement
	Amended assessment method for unit 201	5. Assessment - Summary of assessment methods and conditions

Version and date	Change detail	Section
2.0 August 2019	Unit 215 aim and delivery guidance updated for work experience requirements	Unit 215
2.1 May 2023	Amended assessment method for unit 201 Component number for assessment unit changed from 201 to 200	5 Assessment
	Clarified moderation and external verification processes	6 Moderation and standardisation of assessment
	Updated website links and references	3 Delivering Technicals qualifications - Support materials 8 Administration
2.2 September 2023	Revision to the exam specification for the health and safety test component (200)	5 Exam specification

Contents

1	Introduction	8
	What is this qualification about?	8
	Qualification structure	12
	Total qualification time (TQT)	12
	Assessment requirements and employer involvement	13
2	Centre requirements	14
	Approval	14
	Resource requirements	14
	Learner entry requirements	14
3	Delivering technical qualifications	15
	Initial assessment and induction	15
	Employer involvement	15
	Delivery guidance	15
	Work experience	15
	Support materials	16
4	Employer involvement	17
	Qualification approval	17
	Monitoring and reporting learner engagement	17
	Types of involvement	18
	Types of evidence	19
	Quality assurance process	19
	Sufficiency of involvement for each learner	19
	Live involvement	19
	Timing	19
5	Assessment	20
	Summary of assessment methods and conditions	20
	What is synoptic assessment?	21
	How the assignment is synoptic for this qualification	21
	Assessment objectives	22
6	Moderation and standardisation of assessment	26
	Supervision and authentication of internally assessed work	26
	Internal standardisation	26
	Internal appeal	27
	Post-quality assurance procedures	27
	Centres retaining evidence	27
7	Grading	28
	Awarding grades and reporting results	29
8	Administration	32
	External quality assurance	32

	Enquiries about results	32
	Re-sits and shelf-life of assessment results	33
	Factors affecting individual learners	33
	Malpractice	33
	Access arrangements	33
Unit 201	Health and safety for the land-based industries	35
	What is this unit about?	35
	Learning outcomes	35
	Guidance for delivery	40
Unit 208	Land-based engineering workshop practices	41
	What is this unit about?	41
	Learning outcomes	41
	Guidance for delivery	47
Unit 209	Transmission and driveline operation principles	48
	What is this unit about?	48
	Learning outcomes	48
	Guidance for delivery	51
Unit 210	Engine operation principles	52
	What is this unit about?	52
	Learning outcomes	52
	Guidance for delivery	56
Unit 211	Fabrication, cutting and joining	57
	What is this unit about?	57
	Learning outcomes	57
	Guidance for delivery	61
Unit 212	Land-based vehicle electrics	62
	What is this unit about?	62
	Learning outcomes	62
	Guidance for delivery	66
Unit 213	Hydraulic systems	67
	What is this unit about?	67
	Learning outcomes	67
	Guidance for delivery	70
Unit 214	Land-based vehicle and machinery operation	71
	What is this unit about?	71
	Learning outcomes	71
	Guidance for delivery	76
Unit 215	Working in the land-based engineering industry	77
	What is this unit about?	77
	Learning outcomes	77
	Guidance for delivery	81

1 Introduction

What is this qualification about?

The following purpose is for the **City & Guilds Level 2 Technical Certificate in Land-Based Engineering (QAN 603/0145/4)**

Area	Description
OVERVIEW	
Who is this qualification for?	<p>This City & Guilds Level 2 Technical Certificate in Land-Based Engineering is for you if you are looking to start a career within the land-based engineering sector.</p> <p>A career in land-based engineering could be for you if you like to work as part of a team, working in the outdoors, enjoy problem-solving and are interested in developing your analytical and IT skills.</p> <p>Modern land-based engineering is not just about building larger and more powerful tractors and farm machinery. The skills required include robotics, computer-based imaging, GPS technology, science-based solutions, climate forecasting, technological solutions, environmental controls and much more. Although farming and food production is a major focus, the land-based engineering industry extends into everything from the countryside and forestry to sports-grounds and open spaces. This qualification could start you off on the first steps on your journey to an exciting and rewarding career.</p> <p>This qualification is suitable if you are 16 years old, or over. You may or may not have any previous knowledge or experience in land-based engineering.</p> <p>You will gain an understanding of the skills and knowledge that are important when you are working in a land-based engineering setting, or progressing to further learning and training in this area.</p> <p>City & Guilds has worked with stakeholders in England to development this qualification, and further has worked with stakeholders in Northern Ireland to review these qualifications to ensure that they meet their needs and allow for progression within education and into employment.</p>

Area

What does this qualification cover?

Description

This qualification covers the skills you will need to progress to further learning and training, or to enter the world of work within the land-based engineering industries. You will study the following mandatory content:

- Health and safety for the land-based industries
- Land-based engineering workshop practices
- Transmission and driveline operation principles
- Engine operation principles
- Fabrication, cutting and joining
- Land-based vehicle electrics
- Hydraulic systems
- Land-based vehicle and machinery operation
- Working in the land-based engineering industry

There is also a requirement to complete 150 hours of work experience.

You will get lots of practice and support to enable you to develop the required skills and knowledge to prepare you for the learning and end assessment.

Colleges and training/education centres will work with local employers who will contribute to the knowledge and delivery of training. The different ways in which centres could support your learning, by working with both local and national land-based engineering businesses, include:

- structured work-experience or work-placements within their business
- your attendance at classes or lectures given by industry experts
- employers input into projects and exercises
- employers who act as 'expert witnesses' to contribute to the assessment of your work.

This practical based training is ideal preparation for gaining employment in the land-based engineering industry or further specialist study.

Area	Description
How does this qualification relate to a wider learning programme	<p>This qualification provides an opportunity for you to gain real work specific skills and knowledge, and enables you to link your technical learning to the work experience part of your course.</p> <p>Throughout the qualification, you will benefit from enrichment activities to develop your employability, team work and problem solving skills. These are essential when working in industry.</p> <p>English, maths and digital technology are included within the course, which will assist you with future job opportunities or progression to higher level learning. Regular personal tutorials will help with target setting, enabling you to reflect on and improve your performance and progress.</p>

WHAT COULD THIS QUALIFICATION LEAD TO?

Will the qualification lead to employment, and if so, in which job role and at what level?	<p>Achievement of this qualification demonstrates to an employer that you have the necessary technical skills and knowledge they are looking for when recruiting for a trainee:</p> <ul style="list-style-type: none"> • agricultural machinery technician • land-based service engineer • land-based mechanic
Why choose this qualification over similar qualifications?	<p>There are no other College-based qualifications within this suite at this Level.</p>
Will the qualification lead to further learning?	<p>Yes. Once you have successfully completed this qualification, you could go on to an apprenticeship in Land-based service engineering, which could lead to a job as a Land-based Service Engineer.</p> <p>You could also go onto study a Level 3 College-based qualification over two years:</p> <ul style="list-style-type: none"> • City & Guilds Level 3 Advanced Technical Extended Diploma in Land-based Engineering (1080) <p>This large qualification taken over two years will allow you to study in depth and gain advanced knowledge and higher skills that could lead to a greater range of more diverse career opportunities.</p> <p>You could also progress onto an Apprenticeship as a:</p> <ul style="list-style-type: none"> • Land-based Engineer • Land-based Engineering Technician

WHO SUPPORTS THIS QUALIFICATION?

Area	Description
Professional/Trade Associations	The Institute of Agricultural Engineers (IAgrE) The British Agricultural and Garden Machinery Association (BAGMA) The Agricultural Engineers Association (AEA)

Qualification structure

For the **City & Guilds Level 2 Technical Certificate in Land-Based Engineering** the teaching programme must cover the content detailed in the structure below:

City & Guilds Level 2 Technical Certificate in Land-Based Engineering		
Unit number	Unit title	GLH
Mandatory		
201	Health and safety for the land-based industries	30
208	Land-based engineering workshop practices	60
209	Transmission and driveline operation principles	30
210	Engine operation principles	60
211	Fabrication, cutting and joining	60
212	Land-based vehicle electrics	30
213	Hydraulic systems	30
214	Land-based vehicle and machinery operation	30
215	Working in the land-based engineering industry	30
Total GLH		360

NB – Candidates will be required to complete 150 hours work experience alongside the qualification.

Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
City & Guilds Level 2 Technical Certificate in Land-Based Engineering	360	600

Assessment requirements and employer involvement

To achieve the **City & Guilds Level 2 Technical Certificate in Land-Based Engineering** candidates must successfully complete **all** mandatory assessment components.

Component number	Title
Mandatory	
024	Level 2 Land-Based Engineering - Synoptic assignment
023 or 523	Level 2 Land-Based Engineering – Theory exam
200	Level 2 Health and safety for the land-based industries – Theory exam (evolve online)

In addition, candidates **must** complete the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

Employer involvement

Component number	Title
Mandatory	
828	Employer involvement

*Number of mandatory assessments per assessment type

2 Centre requirements

Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' full Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: www.cityandguilds.com

Resource requirements

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

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following requirements:

- be technically competent in the areas in which they are delivering
- be able to deliver across the breadth and depth of the content of the qualification being taught
- have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- demonstrate continuing CPD.

Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessment.

Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of tutors and markers. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

Age restrictions

This qualification is approved for learners aged 16 – 19, 19+.

3 Delivering technical qualifications

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

Delivery guidance

City & Guilds' Technical qualifications have been designed for delivery in England, Wales and Northern Ireland. Some of the units in this qualification refer to regulations and legislation relevant to the industry and the job role the qualification is designed to prepare the candidate for. Legislation can vary across nations, and where this is the case it is acceptable for centres to teach learners using the appropriate terminology and government department names for the local context. Where assessments are set for these qualifications, City & Guilds will ensure that they are either a) fit for purpose for all nations and local contexts, or, where this is not possible within the parameters of setting appropriate assessment, b) a local assessment version will be provided. Where b) is the case, this will be listed in the qualification handbook and on the City & Guilds Walled Garden.

Work experience

Work experience will provide learners with the opportunity to participate in the world of work and gain practical experience that is relevant to both the qualification and future employment possibilities.

Each learner is expected to complete a 150 hours work experience placement as part of the programme. This work placement should be with an employer that will provide the learner with structured opportunities to develop the skills and knowledge that are relevant to the qualification and should be undertaken in a real business environment relevant to the subject interest of the learner. Work experience may be gained by a number of routes, e.g. as part of an industrial placement whilst within the programme, whilst working on a planned daily or weekly basis on the centre's commercial and/or educational facilities, whilst undertaking voluntary work within the industry, or as a member of a group of learners invited to carry out practical work on a suitable business. The work placement can take place at any time during the learning programme. Centres should be able to provide evidence that the work experience placement has been completed by the learner and this evidence may be reviewed on request by City & Guilds.

The 150 hours work experience is included in the Total Qualification Time

Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments	Available on the qualification pages on the City & Guilds Website: www.cityandguilds.com
Technical Qualifications: Guide to Teaching, Learning and Assessment	Available on the City and Guilds website: 14-19-teaching-learning-assessment-guide-pdf.ashx (cityandguilds.com)
Quality Assurance Guide for Centres: Technical Qualifications and the Extended Project Qualification (EPQ)	Available on the City and Guilds website: technicals-quality-assurance-guide-for-centres-pdf.ashx (cityandguilds.com)

4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and students and furthers collaboration between the learning and skills sector and industry.

[Technical qualifications] must:

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: ***Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90***

City & Guilds will provide support, guidance and quality assurance of employer involvement.

Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planner a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot

provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

Types of involvement

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning. Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows^{1,2}:

The following activities meet the requirement for meaningful employer involvement:

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification³;*
- *students undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.

The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*
- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*

¹ As extracted from: Vocational qualifications for 16 to 19 year olds
2017 and 2018 performance tables: technical guidance for awarding organisations

²This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**

³ **DfE work experience guidance**

- *employers providing students with job references.*

Types of evidence

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. E.g. for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

Quality assurance process

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

Sufficiency of involvement for each learner

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry. Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

Live involvement

Learners will gain most benefit from direct interaction with employers and/or their staff; however the use of technology (e.g. the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

Timing

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

5 Assessment

Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
024	Synoptic assignment	<p>The synoptic assignment is externally set, internally marked and externally moderated. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification.</p> <p>Please note that for externally set assignments City & Guilds provides guidance and support to centres on the marking and moderation process.</p>
023/523	Externally marked exam	<p>The exam is externally set and externally marked and can be taken either online through City & Guilds' computer-based testing platform, (023) or as a paper based test (523).</p> <p>The exams are designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: http://www.jcq.org.uk/exams-office/ice--instructions-for-conducting-examinations</p> <p>The exam specification shows the coverage of the exam across the qualification content.</p> <p>Candidates who fail the exam at the first sitting will have one opportunity to re-sit. If the re-sit is failed the candidate will fail the</p>

		qualification. For exam dates, please refer to the Assessment and Examination timetable.
200	Evolve online on-demand exam	<p>This exam is externally set and externally marked and will be taken online through City & Guilds' computer-based testing platform under invigilated exam conditions. The exam is available on-demand and can be taken at any time in the year.</p> <p>There is no maximum number of retake attempts for this exam, however, learners should be given sufficient time and tutor support before resitting.</p>

What is synoptic assessment?

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high quality outcome.

How the assignment is synoptic for this qualification

The typical assignment brief could be to assess the servicing requirements for land-based engineering vehicle or piece of machinery. This will require the candidate to carry out diagnosis, dismantle, check and reinstate system components in line with standard working procedures.

Learners will complete job cards and service records alongside practical activities, as they would do in the workplace. Learners may also be required to produce a report to support their activities and the implications of practice in the workplace with wider considerations of impacts on the land environment.

Exam for stretch, challenge and integration

The externally marked (023/523) exam draws from across the mandatory content of the qualification, using:

- **Multiple choice questions** to confirm breadth of knowledge and understanding.
- **Multiple choice applied knowledge and understanding questions**, giving candidates the opportunity to demonstrate higher level, integrated understanding through application, analysis and evaluation.

Assessment objectives

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including weightings for the synoptic assignments. In some cases, due to the nature of a qualification's content, it is not appropriate to award marks for some AOs. Where this is the case these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

Assessment objective	City & Guilds Level 2 Technical Certificate in Land-Based Engineering Typical expected evidence of knowledge, understanding and skills	Approximate weighting (Assignment)
<p>AO1 Recalls knowledge from across the breadth of the qualification.</p>	<p>Legislation and regulations, health and safety, the types of businesses and career paths within the land-based engineering industry and the roles and responsibilities of those within the workplace, how to access technical data, technical terminology, workshop processes, land-based machinery and equipment component location, identification and functionality, routine service actions, use maintenance and storage tools, equipment and hardware relevant to repairs and maintenance, knowledge of power units, transmissions, hydraulics, electrics – units of measurement and components, engine uses and types, documentation types, applications for engines</p>	<p>20%</p>
<p>AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.</p>	<p>Health and safety implications, workplace risks assessments, servicing procedures and safety requirements good working practices, understanding of machinery and equipment systems and the function of their components - including engines, hydraulics, transmissions and electrics. Procedures for moving, storing and cleaning machinery and equipment. Importance of professional development and personal behaviours, workshop housekeeping principles and implications, procedures for dismantling, inspecting and reinstating systems, material properties and uses, cutting , shaping and joining processes.</p>	<p>20%</p>

Assessment objective	City & Guilds Level 2 Technical Certificate in Land-Based Engineering Typical expected evidence of knowledge, understanding and skills	Approximate weighting (Assignment)
AO3 Demonstrates technical skills from across the breadth of the qualification.	Working in a safe manner, carrying out machinery and equipment servicing, safety checks and repairs to appropriate specifications and standards, using hand and power tools, special tools, test equipment, and verification tools, use and application of tools and equipment relevant to repairs and maintenance, dismantling, inspecting and reinstating systems, measuring and marking out, cutting, shaping and joining materials, maintenance and testing of electric and hydraulic systems, completing documentation	30%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying knowledge and understanding to a particular scenario/ problem – decisions/approaches taken e.g. planning process, contingencies, completion of reports, explaining actions/ discussing options for repair, and verification of repairs. Considering reliance of machine/vehicle systems on each other.	20%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Working in a safe manner, carrying out pre-use checks on machinery and equipment, verifying work before storing machinery and equipment, ensuring machinery and equipment is stored/handed over in a clean and safe condition, checking details of presentation/assignment, checking the results of servicing tests and inspections, re-checking findings, taking/reading accurate measurements and recording, checking bonded joints	10%

Exam specification

AO weightings per exam

AO	Component 023/523 weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	50
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	30
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20

The way the exam covers the content of the qualification is laid out in the table below:

Assessment type: Multiple choice, written exam*

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

023/ 523	Duration: 2 hours		
Unit	Unit Title	Number of marks	%
209	Transmission and driveline operation principles	7	14
210	Engine operation principles	9	18
212	Land-based vehicle electrics	9	18
213	Hydraulic systems	8	16
214	Land-based vehicle and machinery operation	7	14
N/A	Integration across units	10	20
Total		50	100

*These exams are sat under invigilated examination conditions, as defined by the JCQ:
<http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>

Entry for exams can be made through the City & Guilds Walled Garden.

Assessment type: Multiple-choice exam, delivered online *

Assessment conditions: Invigilated examination conditions

Grading: X/P

Health and Safety for land-based industries – Theory exam (200)		Duration: 1 hour			
Unit	Learning outcome	Number of marks		%	
Health and Safety for land-based industries (201)	1. Understand the impact legislation has on land-based industries	8		31	
	2. Understand risk assessment requirements for land-based industries	4		17	
	3. Know safe working practices when working in land-based industries	13		51	
Total		25		100	

*These exams are sat under invigilated examination conditions, as defined by the JCQ:
<http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>

Entry for exams can be made through the City & Guilds Walled Garden.

6 Moderation and standardisation of assessment

City & Guilds' externally set synoptic assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation.

Moderation is the process where external quality assurers are standardised to a national standard in order to review centre marking of internally marked assessments. These quality assurers are referred to as 'moderators'. Moderators will review a representative sample of 'candidate work' across the mark range from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria within a reasonable range of mark tolerance, centre marks for the whole cohort will be accepted. Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment (up or down) will be made to the marks of the whole cohort, retaining the centre's rank ordering. Due to the nature of the assessment and the marking grid across Assessment Objectives (AOs), it is not expected that the tutors mark and the moderators mark will match exactly.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances, a complete remark of the candidate work may be necessary.

For more detailed information, on the external quality assurance process for synoptic assignments and additional unit assessments please refer to 'Quality Assurance Guide for Centres: Technical Qualifications and the EPQ available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

Supervision and authentication of internally assessed work

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

Internal standardisation

For internally marked work⁴ the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked and/or graded to the same standard. It is the Internal Quality

⁴ For any internally assessed optional unit assignments, the same process must be followed where assessors must standardise their interpretation of the assessment and grading criteria.

Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

Internal appeal

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, i.e. the synoptic assignment and any optional unit assignments. This must take place before the submission of marks or grades for external quality assurance. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

Post-quality assurance procedures

Once the external quality assurance processes have been completed, feedback is provided to the centre on the standard of the internal assessment, highlighting areas of good practice, and potential areas for improvement. This will inform future centre assessment, and standardisation activities, as well as external quality assurance and risk management activity.

Centres retaining evidence

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

7 Grading

Awarding individual assessments

Individual assessments will be graded, by City & Guilds, as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (eg archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the Merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the Merit grade for the qualification overall.

Grade descriptors

To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.
- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan that would credibly achieve an outcome that is highly fit for purpose.

- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The **City & Guilds Level 2 Technical Certificate in Land-Based Engineering** will be reported on a four grade scale: Pass, Merit, Distinction, Distinction*.

All assessments **must** be achieved at a minimum of Pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade Pass for an assessment(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundary for the synoptic assignment(s) in this qualification are:

Synoptic Assignment	Pass Mark (%)
024	40

Please note that each synoptic assignment is subject to an awarding process before final grade boundaries are confirmed.

The health and safety assessment 200 must be passed to achieve the qualification. This assessment is graded pass/fail.

The contribution of assessments towards the overall qualification grade is as follows:

Assessment method	Grade scale	% contribution
Synoptic Assignment (024)	X/P/M/D	60%
Exam (023/ 523)	X/P/M/D	40%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. A range of points between the Pass, Merit and Distinction boundaries will be accessible to candidates. For example a candidate that achieves a middle to high Pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle Merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

	Pass	Merit	Distinction
Assignment: 60%	6	12	18

Exam: 40%

6

12

18

The candidate's points for each assessment are multiplied by the % contribution of the assessment and then aggregated. The minimum points required for each qualification grade are as follows:

Qualification Grade	Points
Distinction*	20.5
Distinction	17
Merit	11
Pass	6

Candidates achieving Distinction* will be the highest achieving of the Distinction candidates.

8 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation (synoptic assessments).

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

External quality assurance

City & Guilds will undertake external moderation activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make arrangements to receive, check and keep assessment material secure at all times,
- maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and
- keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for synoptic assignments.

For further details on enquiries and appeals process and for the application forms, please visit the **centre document library** on the City & Guilds website at www.cityandguilds.com.

Re-sits and shelf-life of assessment results

For the synoptic theory exam and synoptic assignment, candidates who have failed an assessment or wish to re-take it in an attempt to improve their grade, can re-sit assessments **once only**. The best result will count towards the final qualification. See guidance on individual assessment types and re-sit conditions in Section 5.

Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (eg disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document managing cases of suspected malpractice in examinations and assessments.

Access arrangements

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Please refer to the *JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds* for more information. Both are available on the **City & Guilds website**.

Special consideration

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information, please consult the current version of the JCQ document, *A guide to the special consideration process*. This document is available on the **City & Guilds website**.

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to understand the principles, and importance, of health and safety within land-based settings. This unit covers health and safety legalisation which provides the requirements upon which policies and procedures within the industry are based.

Working in land-based roles is exciting and varied but operating in these environments can be dangerous and present potential risks and hazards. As part of this unit learners will look at the legislation that is in place to maintain safety, the requirements for risk assessment and how these impact on working practices.

This unit also introduces learners to the basic requirements of fire prevention, safe manual handling and basic first aid.

Learners should consider the following questions as a starting point to this unit:

- What is the difference between a hazard and a risk?
- What legislation covers health and safety when working in land-based environments?
- How should heavy materials or equipment be moved safely?
- What different types of fire prevention equipment are there?

This unit must be taught alongside **all** technical units within the qualification ensuring learners gain an appreciation of its importance and so that they are equipped with knowledge and understanding to protect themselves and others when working in the industry.

Learning outcomes

In this unit, learners will:

1. Understand the impact legislation has on land-based industries
2. Understand risk assessment requirements for land-based industries
3. Understand safe working practices when working in land-based industries

Learning outcome:

1. Understand the impact legislation has on land-based industries

Topics

1.1 Legislation relevant to land-based industries

1.2 Employer and employee responsibilities

Topic 1.1

Legislation related to the land-based sector, and where it applies.

Legislation:

- Health and Safety at Work Act (HASAW) (1974) / The Health and Safety at Work (Northern Ireland) Order 1978
- Provision and Use of Work Equipment Regulations (PUWER) (1998) / The Provision and Use of Work Equipment Regulations (Northern Ireland) 1999 (PUWER)
- Reporting of Injuries Diseases and Dangerous Occurrences Regulations (RIDDOR) (2013) / Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (Northern Ireland) 1997
- Control of Substances Hazardous to Health (COSHH) Regulations (2002) / Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 - (COSHH (NI))
- Management of Health and Safety at Work Regulations (1999) / Management of Health and Safety at Work Regulations (Northern Ireland) 2000
- Personal Protective Equipment Regulations (PPE) (1992) / Personal Protective Equipment at Work Regulations (Northern Ireland) 1993
- Regulatory Reform (Fire Safety) Order (2005) / The Fire Safety Regulations (Northern Ireland) 2010
- Environmental Protection Act 1990

NB - Health and safety relating to specific tasks/practices will be covered within the relevant specific unit.

Topic 1.2

Employer responsibilities under health and safety regulations:

- Providing healthy work environment – washing facilities, toilets, ventilation, heating and lighting, no smoking policy, first aid
- Providing safe work environment - signage, PPE, fire safety, risk assessments, safe equipment
- Training
- Reporting

Employee responsibilities under health and safety legislation:

- Responsibility for own personal health and safety
- Co-operation with employer
- Not interfering with or misusing equipment/provisions (e.g. alarms, signage) provided for health safety and welfare
- Lines of reporting for:

- accidents
- faults
- damage
- Following instructions and safe working practice – e.g. using PPE where provided
- Helping others and sharing good practice

Learning outcome:

2. Understand risk assessment requirements for land-based industries

Topics

2.1 Risk assessment terminology

2.2 Hazards, risks and control measures

Topic 2.1

Definitions of risk assessment terminology:

- Generic risk assessment
- Site specific
- Task specific
- Emergency action plan
- Method statement
- Hazard
- Risk
- Persons at risk e.g. yourself, colleagues, general public
- Control measures

Topic 2.2

The five step process for risk assessments:

- Identifying hazards
- Deciding who might be harmed and how
- Evaluating risks, deciding on precautions
- Recording finding and implementing
- Reviewing as required

Learning outcome:

3. Understand safe working practices when working in land-based industries

Topics

3.1 Manual handling principles

3.2 Basic first aid procedures

3.3 Fire safety principles

Topic 3.1

Principles of and techniques for manual handling, and consequences of not following:

- Legislative requirement
- Safe lifting techniques
- Use of mechanical aids
- Potential implications of poor manual handling – back injury, dropped and damaged goods/equipment
- That it is covered by manual handling risk assessments

Topic 3.2

First aid situations:

- Wounds/severe bleeding
- Burns
- Shock
- Unconsciousness
- Falls from height

Response to first aid situations:

- Procedures to be taken
- How and when to call for assistance
- Reporting requirements
- Own limitations when responding to first aid emergency

Topic 3.3

Principles of fire safety, procedures to follow, and fire safety equipment and their uses:

- Procedures for raising the alarm
- Evacuations and drills
- Types and uses of fire safety equipment:
 - smoke detectors
 - fire alarms
 - fire extinguishers – water, dry powder, foam, CO2
 - fire blankets
 - fire hoses
- Own limitations when responding to potential fire emergency

Guidance for delivery

This unit links closely with all other units and provides the basis of knowledge required to work safely on all tasks in the range of land-based environments. Tutors should guide learners to develop their understanding of principles of health and safety required for working within the industry as learners will need to understand how these are essential for employment within the sector.

This is a knowledge only unit and although the majority of content could be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to real life working tasks and environments. Reference to this unit should be made when teaching the other practical units that make up this qualification.

It is expected that a range of delivery methods will be used including presentations, classroom discussions and individual study.

Topic 1.1 relates to legislation - there is no requirement for a detailed understanding at this level, but learners must appreciate where there are legislations, what they are and where each applies. Tutors should ensure that they keep up to date with changes and amendments to legislations covered by this unit and include delivery of locally relevant policy and standards where relevant.

Topic 3.2 relates to the procedures that should be followed when dealing with an emergency incident: Stop work, assess the situation, provide first aid, seek assistance, reassess, update risk assessment, record and/or report the incident.

The learning outcome on safe working practices could be supported by visits to, or talks from employers. Representatives from industry could be invited to meet with learners and discuss a typical day in their work setting and best practice in terms of safety procedures and how their daily routine is affected by health and safety procedure and legislation.

This unit is key to the delivery of the practical elements of the units in the qualification. Learners should be encouraged to consider the health and safety considerations before engaging in practical activities for example completing risk assessments before starting jobs.

Level:	2
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop the skills to use tools and equipment when working in a workshop on land-based engineering tasks. Working in engineering workshops can present exciting and diverse opportunities but they can also be busy and potentially dangerous environments.

This unit covers the identification of a wide range of tools and equipment and how to use them safely to perform different tasks. Learners will look at housekeeping and working practices that can improve efficiency and safety, whilst also considering the legislation that relates directly to the use of tools and equipment.

This unit also provides learners with the opportunity to use hand and powered tools from across the workshop to dismantle and reassemble land-based machinery components following a systematic and professional approach.

Learners should consider the following questions as a starting point to this unit:

- What workshop equipment can assist with the safe lifting of heavy loads?
- How does personal protective equipment contribute to safety when using tools?
- What types of component make up land-based machinery?
- How are workshop tools maintained following use?

Learning outcomes

In this unit, learners will:

1. Know requirements for working safely in land-based engineering workshops
2. Use tools and workshop equipment for maintenance of land-based machinery
3. Use fixings and hardware in land-based engineering workshops
4. Dismantle and reassemble land-based machinery components
5. Maintain and store tools and equipment

Learning outcome:

1. Know requirements for working safely in land-based engineering workshops

Topics

1.1 Legislation relating to tools, equipment and chemicals

1.2 Workshop housekeeping principles

1.3 Safe lifting and jacking procedures

Topic 1.1

Employee and employer requirements under health and safety legislation relating to engineering workshops:

- Provision and Use of Work Equipment Regulations (1998) / Provision and Use of Work Equipment Regulations (Northern Ireland) 1999 (PUWER)
- Control of Substances Hazardous to Health (COSHH) Regulations (2002) / Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 - (COSHH (NI))
- Manual Handling Operation Regulations (Northern Ireland) (1992)
- Lifting Operations and Lifting Equipment Regulations (1998) (LOLER) / (NI) 1999
- Health and Safety at Work Act (1974) / The Health and Safety at Work (Northern Ireland) Order 1978
- Control of Vibration at Work Regulations (Northern Ireland) (2005)
- Abrasive Wheels Regulations (1970) / Northern Ireland 1971
- Portable Appliance Testing Regulations (PAT) / The Electricity at Work Regulations (NI) 1991
- Pressure Systems and Transportable Gas Containers Regulations (1989) / Northern Ireland 1991
- Local Exhaust Ventilation (LEV) Workplace Fume and Dust Extraction
- Personal Protective Equipment Regulations (1992) / Personal Protective Equipment at Work Regulations (Northern Ireland) 1993
- Work at Height Regulations (Northern Ireland) (2005)

Topic 1.2

Workshop housekeeping principles when working with tools and equipment:

- Importance of clean tools and work area
- Returning tools and equipment to their allocated place
- Requirements and lines of reporting of broken or damaged tools and equipment
- Disposal of waste materials – hazardous and non-hazardous, environmental impacts
- Efficient use of materials and resources
- Use of PPE
- Implications of personal hygiene – e.g. dermatitis, skin irritants

Topic 1.3

Safe lifting and jacking procedures, techniques and communication methods:

- Selection of equipment
- Identification of safe working loads
- Safe procedures for lifting – chains, hoists, links, straps, cranes, shackles
- Safe procedures for jacking – axle stands, chocks, jacks, brakes
- Safe manual handling techniques
- Communication methods when lifting and jacking

Learning outcome:

2. Use tools and workshop equipment for maintenance of land-based machinery

Topics

2.1 Use of hand tools

2.2 Use of power tools

2.3 Operating workshop equipment

Topic 2.1

Selection and safe use of hand tools:

- Spanners and/or wrenches
- Sockets and accessories
- Pry bars and levers
- Screwdrivers
- Pliers
- Filter straps
- Hammers and punches
- Measuring equipment - Vernier, micrometer, dial test indicator

Topic 2.2

Selection and safe use of power tools:

- Electric power tools
- Air/pneumatic tools

Topic 2.3

Selection and safe use of workshop equipment:

- Press/pulling tools
- De-greasers
- Pillar drill
- Bench grinder
- Pressure washer
- Steam cleaner
- Compressor
- Jacks
- Axle stands
- Lifting equipment

Learning outcome:

3. Use fixings and hardware in land-based engineering workshops

Topics

3.1 Use fixings and fasteners

3.2 Use workshop hardware and consumables

Topic 3.1

Selection and safe use of fixings and fasteners and their specifications:

- Locking and securing devices – Screws, Nuts, Bolts, Washers, Spring washers, Rivets, thread lock
- Specification - Thread types, Units of measurement – imperial and metric, Diameters, Lengths

Topic 3.2

Selection and safe use of workshop hardware and consumables:

Hardware

- Bearing
- Joints (power transmission)

Consumables

- Filters
- Seals
- Belts
- Lubricants / coolants
- Anti-seize fluid

Learning outcome:

4. Dismantle and reassemble land-based machinery components

Topics

4.1 Remove components

4.2 Dismantle, clean and inspect components

4.3 Reassemble, refit and test components

Topic 4.1

Removal of land-based engineering machinery components safely following standard procedures:

- Safe working procedures – risk assessment requirements
- Isolate machine/component where required
- Selection and use of hand and power tools for maintenance
- Check for conformity against specification
- Following manufacturer's procedures

Topic 4.2

Dismantling, cleaning and inspection of land-based engineering machinery components safely following standard procedures:

- Removal of corrosion
- Removal of seals, gaskets and sealants
- Degreasing
- Measurement and checks for wear, contamination or damage

Topic 4.3

Reassembling, refitting and testing of land-based engineering machinery components following standard procedures:

- Manufacturer's procedures
- Re-assembling and refitting procedures
- Functionality testing
- Documentation – completing job card

Learning outcome:

5. Maintain and store tools and equipment

Topics

5.1 Maintain workshop tools

5.2 Store tools

5.3 Prepare and reinstate the workplace

Topic 5.1

Maintenance of hand and power workshop tools following standard procedures:

- Cleaning methods and disposal of waste
- Checks for damage/wear
- Reporting damage or faulty tools

Topic 5.2

Storage of workplace tools following standard procedures:

- Completion of tool set checks
- Storage returns
- Specialist storage requirement – e.g. torque wrench, gas bottles, jacks
- Security against theft

Topic 5.3

Preparation of the workplace and its reinstating, following standard procedures:

- Positioning of equipment and tools
- Application of health and safety equipment and PPE
- Cleaning requirements
- Disposing of waste
- Reporting and escalating encountered issues

- Recording documentation - Time sheets, job cards, parts requisitions, service records.

Guidance for delivery

Tutors should highlight the importance of working safely throughout and link back to the underpinning knowledge from unit 201 'Health and safety for the land-based industries'. Reference to relevant legislation and standards should be made, as necessary throughout delivery of the unit, but there is no requirement for a detailed understanding at this level.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Learners should be encouraged to investigate the different ranges and models of tools available, including new and emerging technologies, and where these might be applied for use in the land-based engineering industry.

The unit presents opportunities for employer engagement for example through visits to local dealerships to see how tools and materials are controlled within a working environment.

This unit has links to all systems units within the qualification as the correct use, storage of tools and good housekeeping are an integral part of practical land based engineering activities.

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to gain the knowledge and skills of transmission systems found in land-based engineering machinery. The unit covers both the underpinning knowledge of the different types of transmission system including their layout and component parts, as well as the practical skills required to take them apart for inspection and maintenance.

This unit provides learners with the opportunity for hands on work, disassembling and reassembling transmission components such as clutches, gear boxes and drive shafts. This involves selecting and using different types of tools and equipment, following methodical working practices and checking machine specifications.

Learners should consider the following questions as a starting point to this unit:

- What is the difference between two and four wheel transmission systems?
- What tools are used when working on transmission components?
- How are transmission components degreased?
- Where can information on transmission specification be found?

Learning outcomes

In this unit, learners will:

1. Understand the operating principles of land-based transmission systems
2. Maintain and service transmission systems
3. Operate transmission systems in land-based vehicles and machinery

Learning outcome:

1. Understand the operating principles of land-based transmission systems

Topics

1.1 Layouts of transmission systems

1.2 Function of major components of transmission systems

Topic 1.1

Layouts and advantages of transmissions systems used in land-based machinery:

- Two wheeled drive
- Four wheeled drive
- Hydrostatic

Topic 1.2

Types and function of major components of transmissions systems used in land-based machinery:

- Clutches, torque convertor and flywheels
- Gear boxes, drop boxes and epicycle reduction units
- Drive shafts, belts and chains
- Front and rear axles , reduction hubs, differentials, crown-wheel and pinion
- Wheels and tracks types and applications
- Four wheel drive
- Power take off (PTO)

Learning outcome:

2. Maintain and service transmission systems

Topics

2.1 Dismantle transmission components

2.2 Inspect transmission components

2.3 Reassemble basic transmission components

Topic 2.1

Dismantling of land-based machinery transmission components following standard procedures:

- Safe working procedures – risk assessment requirements
- Isolation of machine/component where required
- Selection and use of hand and power tools for dismantling
- Checks for conformity against specification
- Following manufacturer's procedures

Topic 2.2

Inspection of land-based machinery transmission components following standard procedures:

- Removal of corrosion
- Degreasing

- Measurement/checks for wear, contamination or damage

Topic 2.3

Reassembling of land-based machinery transmission components following standard procedures:

- Manufacturer's procedures
- Re-assembly and refitting procedures
- Lubrication requirements
- Tests for functionality
- Documentation – completing job card

Learning outcome:

3. Operate transmission systems in land-based vehicles and machinery

Topics

3.1 Transmission types

3.2 Use controls for transmission

Topic 3.1

Identification of transmission types

- Visual inspection of machine configuration
- Referring to operators manual

Topic 3.2

Operation of transmission systems using controls and following standard procedures:

- Components
 - PTO controls
 - Differential lock controls
 - Four wheel drive
 - Forward reverse shuttle
 - Gear selection
 - Clutch
 - Throttle
- Safe starting and stopping procedures
- ISO Warning lights and their meaning

Guidance for delivery

The delivery of this unit could be in conjunction with unit 208 'Land-based engineering workshop practices' and unit 213 'Hydraulics systems'

Tutors should ensure that learners have access to appropriate tools and equipment for the types of transmission system/component and be made aware of the importance of working safely and methodically throughout maintenance.

Tutors should encourage learners to research different types and applications of transmission systems in land-based engineering machinery related to their area of interest.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Employer engagement in this unit could be encouraged through industry representatives being invited to give talks on the advances in transmission systems.

The delivery of transmission systems principles could be linked into engine / performance testing, in particular the transmission of power to the PTO and dynamometer testing.

Unit 210

Engine operation principles

Level:	2
GLH:	60

What is this unit about?

The purpose of this unit is for learners to understand the construction and operation of land-based vehicle engine systems and components. The unit looks at how the components and units are constructed, how they operate and how they interact with other components and systems. Learners will also look at the types and configurations of different engines and their uses for land-based and agricultural machinery.

This unit provides learners with the opportunity to gain practical skills and experience when working on engine systems including air, fuel, and lubrication and cooling. They will use appropriate tools and equipment, work safely and methodically to get engines working smoothly and efficiently.

The unit also covers engine system fluid requirements and engine emissions including the parameters and regulations that are in place to regulate and control them and why this is important.

Learners should consider the following questions as a starting point to this unit:

- What is the difference between a two-stroke and four-stroke engine?
- What is engine emission control?
- How is the performance of engine systems tested?
- What types of engine system fluids are there?

Learning outcomes

In this unit, learners will:

1. Know land-based engine types and configurations
2. Understand components used in land-based engines
3. Know systems for controlling emissions
4. Service and maintain land-based engine systems

Learning outcome:

1. Know land-based engine types and configurations

Topics

1.1 Types and uses of engines

1.2 System configurations

Topic 1.1

Engine types, uses and principles of operation:

- Two-stroke
- Four-stroke
- Diesel Compression Ignition
- Petrol Spark Ignition

Topic 1.2

Engine system configurations:

- Single, Twin and Multi cylinder configurations
- Air cooled, water cooled

Learning outcome:

2. Understand components used in land-based engines

Topics

2.1 Relationship between engine components

2.2 Purpose of ancillary components

2.3 Function of system fluids

Topic 2.1

Purpose of and relationship between engine components:

- Cylinder block components
- Cylinder head components

Topic 2.2

Types and purpose of ancillary components:

- Lubrication system components
- Cooling system components
- Fuel system components
- Ignition system components
- Exhaust system components
- Air intake system components

Topic 2.3

Types and function of system fluids:

- Coolants
- Oils
- Fuels
- Diesel exhaust fluid (DEF)

Learning outcome:

3. Know systems for controlling emissions

Topics

3.1 Impact of legislation on emission control

3.2 Basic systems for emission control

Topic 3.1

The impact legislation has on emission control:

- Overview of emissions tier system
- Reasons for conformity

Topic 3.2

Types of basic systems for emission control:

- Exhaust Gas Recirculation (EGR)
- Selective catalytic reduction (SCR)
- Diesel exhaust fluids (DEF)
- Diesel particulate filters (DPF)

Learning outcome:

4. Service and maintain land-based engine systems

Topics

4.1 Service and maintain engines

4.2 Test engine performance

Topic 4.1

Service of land-based machinery engines following standard procedures:

- Safe working procedures – risk assessment requirements
- Use of hand and power tools
- Selection and replacement of parts required
- Checking and Lubricants and coolants
- Replacement of filters
- Conformity checking, to include, timing, compression testing, oil and fuel consumption, balance
- Checks for leaks
- Manufacturer's procedures

Types of system:

- Air systems
- Fuel systems
- Lubrication systems
- Cooling systems

Topic 4.2

Performance testing of engines following standard procedures:

- Dynamometer testing
- Record results and report

Guidance for delivery

The delivery of this unit could be in conjunction with unit 208 'Land-based engineering workshop practices' and unit 214 'Land-based vehicle and machinery operation'.

Tutors should ensure that learners have access to appropriate tools and equipment for the types of engine system/component and be made aware of the importance of working safely and methodically during maintenance.

Tutors should encourage learners to research different types of engine system in land-based engineering machinery related to their area of interest, the types of components in them and their emissions.

For topic 3.1 there is no requirement for learners to know the details of specific emission legislation, but they should have an awareness of how emission control effects engine development and why this legislation is in place. Tutors should keep up to date with current engine emission controls and deliver the content in outcome three in line with this.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

The learning outcomes in this unit could be supported with employer engagement opportunities such as visits to manufacturers to see engine assembly & vibration testing.

The delivery of engine operation principles could be linked to the delivery of the transmission systems principles, for example particular the transmission of power to the PTO and dynamometer testing.

Level:	2
GLH:	60

What is this unit about?

The purpose of this unit is to give learners the knowledge and skills required to prepare, cut, shape and join a range of materials and to fabricate items to specification. Engineers are often required to create bespoke items to meet a specific need or brief. With the knowledge and practical skills covered in this unit learners will be able to problem solve and respond to the requirements of different situations.

As part of this unit learners will look at the tools, equipment and machinery required to fabricate items as well as the properties of different types of materials to ensure the right one is selected to meet the needs of a job.

This unit also provides learners with the opportunity to mark out, measure and prepare materials, cut and shape them to size, ready for joining by thermal, chemical and mechanical means. There will be an opportunity to learn and use practical skills required by the engineering industry such as MIG and MMA welding.

Learners should consider the following questions as a starting point to this unit:

- What equipment is required when joining metals and materials?
- How does the hardness of a material affect how it is cut?
- How are materials prepared before joining?
- What steps should be followed when joining materials with adhesives?

Learning outcomes

In this unit, learners will:

1. Know the tools and safe practices to be followed in the fabrication of basic engineering components
2. Understand properties of materials used in engineering
3. Measure, mark out and prepare materials for fabrication
4. Fabricate items using joining techniques

Learning outcome:

1. Know the tools and safe practices to be followed in the fabrication of basic engineering components

Topics

- 1.1 Safe working practices
- 1.2 Tools used in fabrication
- 1.3 Machinery used in fabrication

Topic 1.1

Safe working practices when fabricating components:

- Specific legislative requirements:
 - Provision and Use of Work Equipment Regulations (PUWER) (1998)
 - PPE
 - Control of Noise at Work Regulations (2005)
 - Local Exhaust Ventilation (7)
 - Abrasive wheels
 - Vibration
- Selection, inspection and use of tools, machinery and equipment
- Setting and checking of machine guards
- Safe storage and handling of portable gas containers
- Storage of tools, machinery and equipment

Topic 1.2

Tools used in the fabrication of basic engineering components, and what they are used for:

- Marking out tools
- Measuring tools
- Cutting tools
- Shaping tools
- Joining tools
- Positioning and securing tools

Topic 1.3

Machinery and equipment used in the fabrication of basic engineering components, and what they are used for:

- Cutting machines/equipment – oxy acetylene, plasma , guillotine, cutting wheels, powered shears, drills
- Shaping machines/equipment – for basic milling, turning and grinding
- Joining machines/equipment/materials – Welders (MIG and MMA), equipment, soldering equipment, adhesives

Learning outcome:

2. Understand properties of materials used in engineering

Topics

2.1 Basic material properties

2.2 Types and uses of materials

Topic 2.1

Definitions of basic material properties:

- Hardness
- Ductility
- Brittleness
- Conductivity
- Strength

Topic 2.2

Types of materials used in fabrication and their uses:

- Metals – ferrous and non-ferrous
- Non-metals – plastics, composites, glass, rubber, wood

Learning outcome:

3. Measure, mark out and prepare materials for fabrication

Topics

- a. Measure and mark out materials
- b. Cut and shape materials using hand tools and powered methods

Topic 3.1

Measuring and marking out materials prior to fabrication following standard procedures:

- Review and interpretation of engineering drawing
- Selection of measuring and making tools
- Reading and interpretation of scales – units of measurement
- Marking out materials within required tolerances – as indicated on engineering drawing

Topic 3.2

Cutting and drilling materials for fabrication using hand tools and powered methods following standard procedures:

- Select and use of tools appropriate for materials
- Position and secure with appropriate equipment – clamps/vices
- Follow safe operating procedures for cutting tools – hand and powered
- Prepare/clean surfaces
- Smooth edges/remove burrs following cutting.

Learning outcome:

4. Fabricate items using joining techniques

Topics

4.1 Use thermal techniques

4.2 Use mechanical techniques

4.3 Use chemical techniques

Topic 4.1

Joining materials using thermal techniques, following standard procedures:

- Select and use tools as appropriate for materials
- Position and secure with appropriate equipment – clamps/vices
- Prepare/clean surfaces
- Follow safe operating procedures for:
 - MIG
 - MMA
 - Soldering
- Inspect and check thermal joint

Topic 4.2

Joining materials using mechanical techniques, following standard procedures:

- Select and use tools as appropriate for materials
- Position and secure with appropriate equipment – clamps/vices
- Prepare/clean surfaces
- Drill/ream and tap holes to specified dimensions as required
- Follow safe operating procedures for:
 - Riveting
 - Applying mechanical fixtures/hardware – nuts, bolts, screws
- Inspect and check joint formation

Topic 4.3

Joining materials using chemical techniques, following standard procedures:

- Select and use tools as appropriate for materials
- Position and secure with appropriate equipment – clamps/vices
- Prepare/clean surfaces
- Follow safe operating procedures for handling chemicals (COSHH):
 - Single part adhesive
 - Two part adhesive
- Observe curing procedures as per product data sheet
- Inspect and check chemical joint

Guidance for delivery

The delivery of this unit could be in conjunction with unit 208 'Land-based engineering workshop practices'.

Tutors should ensure that learners have access to the appropriate tools and equipment for the different types of cutting, joining and fabrication techniques and be made aware of the importance of working safely and methodically when using them.

This unit provides an opportunity for potential employer engagement around the specific uses of joining, cutting and fabrication techniques and methods in real work places. This could include discussions on the use of emerging techniques and technologies such as laser cutting and plastic welding and how these used or accessed locally.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

The knowledge, skills and understanding in this unit could be supported through employer engagement by visits to local companies to see automated / robotic welding and discussing how these contrast with manual welding.

This unit has links to the workshop practices units as well as the general principles of vehicle repair covered across the vehicle system unit.

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to look at the basic electric systems found in land-based vehicles, understand how they work, and gain experience in the testing and maintaining them. There are many uses for electric circuits within vehicles and machines and knowing their components and how these circuits work is key to being able to maintain their performance.

Learners will look at the different types of electric circuit, how all the components connect up and interact together as well as how these are represented on diagrams. The unit also considers units of electrical measurement, the differences between them and when they should be used, along with the specific health and safety considerations that cover working with electricity.

This unit also provides learners with the opportunity to maintain and test a range of systems found in land-based vehicles to make sure they are operating correctly, including starting, charging and lighting systems.

Learners should consider the following questions as a starting point to this unit:

- What is the difference between a series circuit and a parallel circuit?
- Where in land-based vehicles are electric circuits found?
- How are vehicles jump started?
- What safety considerations are there when working with electricity?

Learning outcomes

In this unit, learners will:

1. Understand electrical system circuit types and components
2. Maintain and test circuits on land-based vehicles and machinery

Learning outcome:

1. Understand electrical system circuit types and components

Topics

1.1 Types and uses of circuits

1.2 Electrical circuit components

1.3 Units of electrical measurement

1.4 Electrical safety considerations

Topic 1.1

Circuit types used in machinery and their uses:

Types

- Series
- Parallel

Uses

- Starting
- Charging
- Lighting

Topic 1.2

Electrical circuit components and their symbols as used on basic circuit diagrams:

- Cables – sizing, colour coding and application
- Switches
- Terminals
- Bulbs
- Starter motors
- Alternators
- Fuses
- Batteries
- Relays

Topic 1.3

Units of measurements for electrical circuits:

- Volts
- Amps
- Ohms
- Watts

Topic 1.4

Specific safety considerations when dealing with electricity:

- Safety to the person
 - Risk of electrical burn/shock
 - Battery hazards – chemical burn, corrosion, explosion, lifting/weight considerations

- Safety to the vehicle
 - Risk of short circuits
 - Risk of fire
 - Damage to electronics

Learning outcome:

2. Maintain and test circuits on land-based vehicles and machinery

Topics

2.1 Maintain and test batteries

2.2 Maintain and test starting systems

2.3 Maintain and test charging systems

2.4 Maintain and test lighting systems

2.5 Record and report testing

Topic 2.1

Maintenance and testing of batteries following standard procedures:

- Jump starting
- Battery terminal removal
- Battery charging
- Tests:
 - Specific gravity
 - Rapid discharge
 - Multi-meter
- Battery reconnection

Topic 2.2

Maintaining and testing starting systems safely following standard procedures:

- Battery terminal removal
- Corrosion prevention and removal
- Starter motor removal
- Bench tests
- Refitting and reconnecting of starter motor and battery
- Testing starting system

Topic 2.3

Maintenance and testing of charging systems safely following standard procedures:

- Battery terminal removal
- Alternator removal
- Belt removal
- Refitting and reconnection of belts, alternator and battery
- Belt tensioning

- Voltage testing of charging system

Topic 2.4

Maintenance and testing of lighting systems safely following standard procedures:

- Lighting unit removal
- Bulb testing and changing
- Fuse testing and changing (continuity)
- Refitting and reconnection of lighting unit/bulb
- Cable routing and security
- Replacement of wiring, connectors, and terminals and their fixation methods
- Battery reconnection

Topic 2.5

Recording and reporting test results following standard procedures:

- Recording system – electronic/manual
- Job card details:
 - Risk assessment
 - Details of vehicle
 - Parts used
 - Work carried out
 - Recommended further action
 - Signatures

Guidance for delivery

The delivery of this unit could be in conjunction with unit 208 'Land-based engineering workshop practices'.

Tutors should ensure that learners have access to appropriate tools and equipment for the types of electric system they are working on and be made aware of the importance of working safely and methodically, particularly with reference to the use of electricity and added safety implications of this.

Tutors should note that this unit covers ancillary electrical systems for vehicles common to both SI and CI types. Although the unit covers some broad electrical principles learners should be brought to focus on vehicle electrical systems specifically.

For topic 2.2, spark ignition is covered in more depth within unit 210 'Engine operation in land-based machinery'.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

The unit presents opportunities for employer engagement for example through the demonstration of the latest equipment by local employers to show how electrical & electronic control systems are advancing all the time.

The higher level of electronic control covered within the learning of this unit presents potential links to the delivery of engines, transmissions and hydraulics principles.

Unit 213

Hydraulic systems

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to look at hydraulic systems found in land-based vehicles and machinery, understand how they work and gain experience in taking them apart for inspection and then putting them back together. There are many uses of hydraulic circuits, such as in steering and brakes - knowing these hydraulic system components and how their circuits work is vital when working on their maintenance.

As part of this unit learners will look at the different types of hydraulic circuit, how the components connect and work together as well as how these are presented on schematic diagrams. The unit also looks at the key health and safety considerations that cover working with hydraulic systems as well as the environmental factors such as the proper disposal of hydraulic fluid.

This unit provides learners with the opportunity to dismantle and inspect a range of hydraulic systems found in land-based vehicles to make sure they are operating correctly including checking for leaks and signs of wear.

Learners should consider the following questions as a starting point to this unit:

- What different components make up a hydraulic circuit?
- Where are hydraulics used in land-based vehicles and machinery?
- How are leaks in hydraulic systems identified?
- What are the specific safety risks when working on hydraulic systems?

Learning outcomes

In this unit, learners will:

1. Understand hydraulic system circuit types and components
2. Dismantle, inspect and reassemble hydraulic systems

Learning outcome:

1. Understand hydraulic system circuit types and components

Topics

1.1 Hydraulic circuit types

1.2 Hydraulic circuit components

1.3 Safety considerations

Topic 1.1

Hydraulic circuit types and their applications:

Types

- Open
- Closed
- Load sensed

Applications:

- High pressure – trailer brakes, linkage, auxiliaries
- Low pressure – power take off, transmissions, steering

Topic 1.2

Basic hydraulic circuit components and their symbols as used on basic circuit diagrams:

- Pipes
- Valves
- Pumps
- Cylinders
- Reservoirs
- Oil coolers
- Seals and their applications
- Filters, suction and pressure
- Hydraulic fluid

Topic 1.3

Specific safety considerations when dealing with hydraulics:

- Safety to the person:
 - High pressure system implications
 - Chemical hazards – toxicity, dermatitis
 - Release of stored pressure
- Environmental safety considerations
 - Hydraulic fluid disposal
 - Hydraulic fluid leakage
 - Legislative requirements

Learning outcome:

2. Dismantle, inspect and reassemble hydraulic systems

Topics

2.1 Dismantle hydraulic systems

2.2 Inspect hydraulic system components

2.3 Reassemble hydraulic systems

2.4 Record and reporting test results

Topic 2.1

Dismantling land-based machinery hydraulic systems components following standard procedures:

- Safe working procedures – risk assessment requirements
- Best working practices - cleaning and avoidance of contamination
- Release of stored energy
- Hand and power tools required
- Conformity against specification
- Manufacturer's procedures

Topic 2.2

Inspecting land-based machinery hydraulic systems following standard procedures:

- Leak inspection
- Measures/checks for wear, contamination or damage
- Pre-repair pressure and flow testing

Topic 2.3

Reassembling land-based machinery hydraulic components following standard procedures:

- Manufacturer's procedures
- Re-assembling and refitting procedures
- Functionality tests – flow and pressure test

Topic 2.4

Recording and reporting test results following standard procedures:

- Recording system – electronic/manual
- Job card details:
 - Risk assessment
 - Details of vehicle
 - Parts used
 - Work carried out
 - Recommended further action
 - Signatures

Guidance for delivery

The delivery of this unit could be in conjunction with unit 208 'Land-based engineering workshop practices' and unit 209 'Transmission and driveline operation principles'.

Tutors should ensure that learners have access to appropriate tools and equipment for the types of hydraulic system they are working on and be made aware of the importance of working safely and methodically.

Although much of the content will be delivered in a workshop environment, it is important that learners can relate this knowledge and understanding to actual workplace situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Employer engagement in this unit could be encouraged through industry talks on advancements in hydraulics.

The delivery of this unit would link well to the content in the electrics and machinery operation units, particularly around the coupling of machinery to land-based engineering vehicles.

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to use and maintain land-based vehicles and machinery. The use of these types of vehicles and machinery is essential to the day to day smooth running of land-based industries. Land-based machinery is relied upon to carry out a wide range of essential tasks. Land-based vehicles and machinery can be expensive, complicated and state of the art and must be used with care and consideration during operation and maintenance.

This unit provides learners with the opportunity to drive and operate land-based vehicles and machinery, hitch and unhitch attachments and carry out pre and post operational checks that are vital to ensure correct maintenance. Alongside these practical skills learners will look at the types of land-based vehicles and machinery available and their key components, as well as the legislation and codes of practice that cover their use.

Learners should consider the following questions as a starting point to this unit:

- What different controls do land-based vehicles have?
- How can machinery be maintained to ensure smooth running?
- What checks are carried out on land-based vehicles before they are used?
- What codes of practice cover the operation of land-based machinery?

Learning outcomes

In this unit, learners will:

1. Know land-based vehicle components and operational checks
2. Know types of machinery used in land-based settings
3. Operate land-based vehicles and machinery
4. Complete hitching procedures for land-based vehicles
5. Maintain and store land-based machinery

Learning outcome:

1. Know land-based vehicle components and operational checks

Topics

1.1 Legislation and regulation relating to the operation of land-based vehicles

1.2 Land-based vehicle components and controls

Topic 1.1

Legislations and codes of practice relating to the safe use and operation of land-based vehicles:

- Highway code
- Health and Safety at Work Act (HASAW) (1974) / Health and Safety at Work (Northern Ireland) Order 1978 – including importance of risk assessments
- Provision and Use of Work Equipment Regulations (PUWER) (1998) (Northern Ireland 1999)
- Waste management regulations
- Personal Protective Equipment at Work Regulations (1992) / Personal Protective Equipment at Work Regulations (Northern Ireland) 1993
- Manual Handling Operations Regulations (1992)
- Management of Health and Safety at Work Regulations (1999) (Northern Ireland 2000)
- Control of Substances Hazardous to Health Regulations (COSHH) (2002) (Northern Ireland 2003 - COSHH (NI))

For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and where each applies.

Topic 1.2

Types and functionality of basic land-based vehicle components and controls.

Components:

- Wheels/tyres
- Lights
- Mirrors
- Indicators
- Systems – hydraulics, power take off, engine
- Safety devices – load indicators, horns, lights
- Service liquids - Oil, Water, Fuel

Controls:

- Steering
- Indicators
- Hydraulic spool valves
- Accelerator
- Independent brake / handbrake
- Hitch

- Specific electric system controls –e.g. global positioning systems / auto steering systems
- Clutches
- Gears – including ranges within the gears.

Learning outcome:

2. Know types of machinery used in land-based settings

Topics

2.1 Types of land-based machinery

2.2 Factors affecting use of land-based vehicles

Topic 2.1

Types of powered and non-powered land-based machinery and equipment, and their uses:

- Cultivating machinery
- Planting machinery
- Application machinery
- Harvesting machinery
- Materials handling machinery
- Estate maintenance machinery

Topic 2.2

Factors affecting the selection and use of land-based vehicles and machinery:

- Time in the farming year / seasons
- Specific health and safety considerations – legislation, risk assessments
- Compatibility with power unit
- Suitability for task
- Training required

Learning outcome:

3. Operate land-based vehicles and machinery

Topics

3.1 Complete starting and stopping procedures on vehicles

3.2 Complete checks on land-based machinery

3.3 Operate land-based vehicles and machinery

3.3 Clean and decontaminate land-based vehicles

Topic 3.1

Completing pre operation checks for land-based vehicles following standard procedures:

- Tyres – pressure, wear, damage
- Service liquid levels – Oil (engine/hydraulic) water, fuel, diesel exhaust fluids
- Air cleaner and cooling systems checks
- Visual checks for road worthiness and vehicle safety – e.g. lights, horns, checks for damage

- specific checks as required from risk assessment – e.g. handling oil

Topic 3.2

Completing checks on land-based machinery following standard procedures:

- Service liquid levels – Oil (engine/hydraulic/gear) water, fuel, diesel exhaust fluids
- Visual checks for safety and operational readiness – e.g. checks for damage, safety shut off switches, webs/grids clear and ready to use, guards in place, tyres
- Specific checks as required from risk assessment – e.g. handling oil
- Checks of implement as per specification and manufactures handbook
- Road test procedures

Topic 3.3

Operation of land-based vehicles using basic controls and following standard procedures:

- Starting/stopping procedures including site specific risk assessment requirements
- Hydraulics/electrical controls
- PTO – speed selection and application
- Fluent use of gear ranges and speeds

Control and manoeuvre land-based vehicles:

- Driving fluently in straight lines and round obstacles and in confined spaces
- Reversing / back up to machinery

Operation of non-powered, powered and trailed machinery following standard procedures:

- Hitching and attaching procedures
- Set up machinery as per manufacturers specification
- Power up and down as per machine specification
- Reporting cases of fault, damage, inefficiency and breakdown where required
- Follow health and safety procedures

Learners must take into consideration weather and situational/terrain conditions during operation – e.g. wet, dry, icy

Topic 3.4

Completing post operation checks for land-based vehicles following standard procedures:

- Cleaning and decontamination
- Refuelling (or recharging)
- Reporting faulty and damaged components
- Storing/parking with consideration for security and safety

Learning outcome:

4. Complete hitching procedures for land-based vehicles

Topics

4.1 Attach implements to land-based vehicles

4.2 Detach implements from land-based vehicles

Topic 4.1

Completing attaching procedures for implements to land-based vehicles:

- Non powered and powered implements for attachment to land-based vehicles considering compatibility:
 - three point linkage
 - trailed equipment
- Isolating power unit / use of external and remote controls
- Ensuring vehicle and implement is ready for safe transport and/or testing

Topic 4.2

Completing detaching procedures for implements from land-based vehicles:

- Disconnect attachment of implement following transport/test
- Select and use appropriate methods to ensure safe storage of machinery

Learning outcome:

5. Maintain and store land-based machinery

Topics

5.1 Maintain land-based equipment and machinery

5.2 Clean and store land-based equipment and machinery

Topic 5.1

Maintenance of land-based equipment and machinery following standard procedures:

- Lubricating, oiling and greasing
- Repairing / replacing / maintaining worn, damaged, loose parts – e.g. plough point, damaged chain, missing blades, tines, tightening bolts, tensioning belts
- Recording and reporting where replacement of parts is required, when it has been implemented or further intervention is required

Topic 5.2

Clean and store land-based equipment and machinery following standard procedures:

- Cleaning, decontamination and corrosion proofing
- Storing safely and securely as per machine specification – utilising jacks/stands, chocks
- Adherence to specific health and safety requirements

Guidance for delivery

When operating land-based vehicles and machinery consideration of vehicle power and specification should be made and related to candidate experience of and stage of course delivery.

The controls and systems covered will need to be as per the specification of the particular make and model available. However learners should know that there are differences in machine specifications and how this might impact on the presentation of components – e.g. location of controls in vehicles may vary. Tutors should ensure consistent reference is made to manufacturer’s handbook/ instructions/ operators manual for both vehicle and implements.

As part of this unit, learners are required to attach implements to land-based vehicles but are not specifically required to operate the vehicle with implements attached.

Reference to relevant legislation and standards should be made, as necessary throughout delivery of the unit, but there is no requirement for a detailed understanding at this level.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers. Learners should be encouraged to investigate the different ranges and models of land-based vehicles and machinery available and their application as per land use and employer requirements for the local area.

The learning outcomes in this unit could be supported with employer engagement opportunities such as the possible negotiation of the short term loan of new equipment or manufacturer demonstrations.

This unit presents good links to the mechanical units within the wider qualification i.e. engines, electrics, hydraulics and transmissions.

Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to explore the land-based engineering industry and opportunities within it. Working within land-based engineering is hard work and hands-on, but can also be exciting and varied, with many different career and job opportunities. From the very beginning of being employed within the sector there is the opportunity to work practically and directly impact the success of a business.

Learners will gain an understanding of the breadth of services delivered in the industry, the requirements expected of them and the prospects of working within these types of role.

Learners should consider the following questions as a starting point to this unit:

- What organisational bodies support the land-based industry?
- What types of further study and learning are there in the industry?
- What are the benefits of working in the land-based engineering industry?
- What job opportunities are there within the land-based engineering industry?

As part of the unit requirements, learners must achieve 150 hours of work experience within the industry. This requirement is subject to external quality assurance through sampling of learner evidence, which must be provided by centres upon request by City & Guilds.

Learning outcomes

In this unit, learners will:

1. Know the structure of the land-based engineering industry, including career opportunities
2. Understand personal attributes required for success in the land-based engineering industry
3. Know basic uses of technology in the land-based engineering industry

Learning outcome:

1. Know the structure of the land-based engineering industry, including career opportunities

Topics

1.1 Structure of the land-based industry

1.2 Work opportunities in the land-based engineering industry

Topic 1.1

Structure of the land-based engineering industry:

- Types of land-based engineering business:
 - Agricultural
 - Forestry and arboriculture
 - Ground care
 - Horticultural
- Types of workers:
 - Permanent
 - Temporary
 - Casual
 - Seasonal
 - Apprentices
 - Contractors
- Organisational and legislative bodies:
 - National Farmers' Union (NFU)
 - IAgRE (LTA scheme)
 - AEA
 - BAGMA
 - LANDEX
 - LANTRA

Topic 1.2

Job roles and potential career opportunities for progression within the industry:

- Entry level roles:
 - Apprentice
 - Workshop technician
- Middle level roles:
 - Workshop foreman
 - Master technician
 - Manufacturer Service Trainer
- Management and higher level roles:
 - Depot Manager
 - Dealer Principal
 - After Sales Manager
 - Training Manager
- Salary expectations
- Educational / entry requirements / progression

Learning outcome:

2. Understand personal attributes required for success in the land-based engineering industry

Topics

2.1 Personal qualities and work ethics required in the land-based engineering industry

2.2 Methods of self-development

Topic 2.1

Factors that contribute to generating a positive work ethic required for success in the land-based engineering industry and the benefits of displaying them:

- Good time management and planning
- Demonstrating initiative
- Teamwork
- Positive and open communication
- Working safely and carefully
- Knowing and working within the limits of personal responsibility

Topic 2.2

Methods of personal self-development which can improve employability within the land-based engineering industry:

- Mentoring
- Self-reflection / recording personal development
- Networking and research – discussion groups, industry visits, job searches
- Positive use of social media for self-promotion
- CPD
- Work experience
- CV development
- Interview experience and techniques

Learning outcome:

3. Know basic uses of technology in the land-based engineering industry

Topics

3.1 Uses of technology in land-based engineering

Topic 3.1

Uses of technology in land-based engineering activities:

- GPS systems in land-based vehicles and machinery
- Mobile apps
- Automated steering systems
- Mechanisation/robotics
- Electronic diagnosis
- Hybrid technology

- Telemetry

Guidance for delivery

For topic 1.1 tutors should ensure that they keep up to date with changes and amendments to current titling of organisational bodies and include delivery of locally relevant examples where possible.

Learners should be encouraged to investigate career and job opportunities that are available in the local area. This unit would be well supported by visits to, or talks from employers from a variety of the areas covered in the unit content. Representatives from industry should be invited to meet with learners and discuss a typical day in their work setting, including reference to personal values, behaviours and how they work in partnership with other roles. There could also be an opportunity to bring in ex-students to discuss their progression.

This unit should be undertaken in a real business environment relevant to the subject interest of the learner but work experience may be gained by a number of routes, e.g. as part of an industrial placement whilst within the programme, whilst working on a planned daily or weekly basis on the centre's commercial and/or educational facilities, whilst undertaking voluntary work within the industry, or as a member of a group of learners invited to carry out practical work on a suitable business.

Any Act or legislation that is sector specific should be adhered to.

Learners must complete 150 hours work experience. Centres should be mindful of their responsibilities for ensuring that work placements have appropriate supervision, insurance and health and safety policies in place and that learners have access to appropriate support whilst on placement. This requirement is subject to external quality assurance through sampling of learner evidence, which must be provided by centres upon request by City & Guilds.

Provided it meets the requirements detailed in the Qualification Handbook and the Employer Involvement Centre Guidance, this work experience can also count as the meaningful employer involvement component that all learners are also required to undertake.

In these instances, centres must record work experience activities on the Employer Involvement Planner and Tracker and retain records confirming each learner's attendance at these placements. These must be made available to City & Guilds if required, as part of our standard quality assurance monitoring.

The knowledge, skills and understanding in this unit could be supported through employer engagement by visits and talks by local dealers to explain what the sector looks like, a typical dealership structure, job opportunities and requirements of employers.

This unit provides a good holistic overview of the requirements and structure of the sector.

Appendix 1 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.

City & Guilds Centre Manual

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

Our Quality Assurance Requirements

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

Useful contacts

UK learners General qualification information	E: learnersupport@cityandguilds.com
International learners General qualification information	E: intcg@cityandguilds.com
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	E: centresupport@cityandguilds.com
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	E: singlesubjects@cityandguilds.com
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	E: intops@cityandguilds.com
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	E: walledgarden@cityandguilds.com
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: business@cityandguilds.com

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: **feedbackandcomplaints@cityandguilds.com**

About City & Guilds

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. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and candidates studying for City & Guilds qualifications may photocopy this document free of charge and/or include a PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching candidates working towards a City & Guilds qualification, or for internal administration purposes
- candidates may copy the material only for their own use when working towards a City & Guilds qualification

The Standard Copying Conditions (see the City & Guilds website) also apply.

City & Guilds

5-6 Giltspur Street

London EC1A 9DE

www.cityandguilds.com