

# **Level 3 Advanced Technical Extended Diploma in Land-Based Engineering (0171-015/0171-515)**

**Part of 0171-038**

**June 2019 Version 2.0**

**Guide to the examination**

Version and date	Change detail	Section
V 2-0 - 18 October 2019	Level 3 third retake opportunity guidance added	1. Details of the exam

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## Who is this document for?

This document has been produced for centres who offer **City & Guilds Level 3 Advanced Technical Extended Diploma in Land-Based Engineering**. It gives all of the essential details of the qualification's external assessment (exam) arrangements and has been produced to support the preparation of candidates to take the exam/s.

The document comprises four sections:

1. **Details of the exam.** This section gives details of the structure, length and timing of the exam.
2. **Content assessed by the exam.** This section gives a summary of the content that will be covered in each exam and information of how marks are allocated to the content.
3. **Guidance.** This section gives guidance on the language of the exam, the types of questions included and examples of these, and links to further resources to support teaching and exam preparation.
4. **Further information.** This section lists other sources of information about this qualification and City & Guilds Technical Qualifications.

# 1. Details of the exam

## External assessment

City & Guilds Technical qualifications have been developed to meet national policy changes designed to raise the rigour and robustness of vocational qualifications. These changes are being made to ensure our qualifications can meet the needs of employers and Higher Education. One of these changes is for the qualifications to have an increased emphasis on external assessment. This is why you will see an external exam in each of our Technical qualifications.

An external assessment is an assessment that is set and/or marked by the awarding organisation (ie externally). All City and Guilds Technical qualifications include an externally set and marked exam. This must be taken at the same time by all candidates who are registered on a particular qualification. We produce an exam timetable each year. This specifies the date and time of the exam so you can plan your delivery, revision and room bookings/PC allocation in plenty of time.

The purpose of this exam is to provide assurance that all candidates achieving the qualification have gained sufficient knowledge and understanding from their programme of study and that they can independently recall and draw their knowledge and understanding together in an integrated way. Whilst this may not be new to you, it is essential that your learners are well prepared and that they have time to revise, reflect and prepare for these exams. We have produced a Teaching, Learning, and Assessment guide that is you should refer to alongside the present document ([Teaching, Learning and Assessment Guide](#)). If a learner does not pass the exam at their first attempt, there is only one opportunity to resit the exam, so preparation is essential.

## Exam requirements of this qualification

The exam is graded and a candidate must achieve at least a Pass grade in order to be awarded the qualification. (In addition to the exam, a synoptic assignment must also be completed and passed. You can find full details of the synoptic assignment in the *Qualification Handbook* and the *Synoptic Assessment Guide* -please see the links at the end of this document).

## When does the exam take place?

- **Level 3 Land based Engineering** – Theory exam (1) (2 hours).

The exam is graded and a candidate must achieve at least a Pass grade in order to be awarded the qualification. (In addition to the exam, a synoptic assignment must also be completed and passed). You can find full details of the synoptic assignment in the *Qualification Handbook* and the *Synoptic Assessment Guide* – please see the link to the qualification page at the end of this document.

## When does the exam take place?

The exam is offered on two fixed dates in March or June. The exact dates will be published at the start of the academic year in the *Assessments and Exam Timetable* <http://www.cityandguilds.com/delivering-our-qualifications/exams-and-admin>.

At the start of the programme of study, in order to effectively plan teaching and exam preparation, centres should know when the exam will be taking place and allocate teaching time accordingly. Section 2 of this document gives a summary of the content that needs to be covered in order to prepare learners for the exam and full details of this are given in the *Qualification Handbook*.

## Form of exam

The exam for this qualification can be taken either on paper (0171-515) or online (0171-015).

## Can candidates resit the exam?

Candidates who have failed an exam or wish to retake it in an attempt to improve their grade, can do so **twice**. The third and final retake opportunity applies to Level 3 only. The best result will count towards the final qualification. If the candidate fails the exam three times then they will fail the qualification.

## How the exam is structured

Each exam has a total of 60 marks available and is made up of:

- approximately 10-12 short answer questions;
- 1 extended response question.

Multiple choice and short answer questions are used to confirm **breadth of knowledge and understanding**.

The extended response question is to allow candidates to demonstrate **higher level and integrated understanding** through written discussion, analysis and evaluation. This question also ensures the exam can differentiate between those learners who are 'just able' and those who are higher achieving.

More details about and examples of question types are given in Section 3 of this document.

## Assessment Objectives

The exams are based on the following set of assessment objectives (AOs). These are designed to allow the candidate's responses to be assessed across the following three categories of performance:

- **Recollection** of knowledge.
- **Understanding** of concepts, theories and processes.
- **Integrated application** of knowledge and understanding.

In full, the assessment objectives covered by the exam for this qualification are:

Assessment objective	Mark allocation (approx %)
<i>The candidate..</i>	
AO1 <b>Recalls knowledge</b> from across the breadth of the qualification	20%
AO2 <b>Demonstrates understanding</b> of concepts, theories and processes from a range of learning outcomes.	60%
AO4 <b>Applies knowledge, understanding and skills</b> from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20%

## **Booking and taking the exam**

All assessments for City & Guilds Technical Exams must be booked through Walled Garden. There is a deadline for booking exams, synoptic assessments and any other centre marked assessments, please refer to the time line to check these dates.

The exam must be taken under the supervision of an invigilator who is responsible for ensuring that it is conducted under controlled conditions. Full details of the conditions under which the exam must be taken can be found in the Joint Council for Qualifications (JCQ) document, [Instructions for Conducting Examinations \(ICE\)](#).

## **Special consideration**

Candidates who are unable to sit the exam owing to temporary injury, illness or other indisposition at the scheduled time may qualify for special consideration. This is a post-examination adjustment that can, in certain circumstances, be made to a candidate's final grade. The Joint Council for Qualifications' guide to the special consideration process can be found at [www.jcq.org.uk](http://www.jcq.org.uk).

To make a request for special consideration, please contact: [policy@cityandguilds.com](mailto:policy@cityandguilds.com)

## **Access arrangements**

Access arrangements are arrangements that allow candidates with particular requirements, disabilities or temporary illness to take assessments, where appropriate, using their normal way of working. The Joint Council for Qualifications document, *Access Arrangements and Reasonable Adjustments* gives full details and can be downloaded [here](#).

For further information and to apply for access arrangements please see:

[Access arrangements - When and how applications need to be made to City & Guilds](#)  
[Applying for access arrangements on the Walled Garden](#)

## 2. Content assessed by the exam

The exam assesses:

- **Unit 350: Understand Land-based Service Engineering Calculations**
- **Unit 352: Repair Land-based Compression-Ignition (Diesel) Engines**
- **Unit 353: Repair Land-based Spark-Ignition (Petrol) Engines**

Each exam assesses a sample of the content of these units. This means that a single exam will **not** cover 100% of the unit content . The full range of content will be assessed over a number of examination series. Details of the coverage of a particular exam paper will **not** be released in advance of the exam itself. Centres should **not** make assumptions about what will be assessed by a particular exam based on what has been covered on previous occasions. In order to be fully prepared for the exam, learners **must** be ready to answer questions on **any** of the content outlined below.

The table below provides an overview of how the qualification’s Learning Outcomes are covered by each exam and the number of **marks** available per Learning Outcome (ie **not** the number of *questions* per Learning Outcome). In preparing candidates for the exam, we recommend that centres take note of the number of marks allocated to Learning Outcomes and to assign teaching and preparation time accordingly.

In preparing candidates for the exam, centres should refer to the Qualification Handbook which gives full details of each Learning Outcome.

The following is a summary of only that qualification content which is assessed by the exam and **not** a summary of the full content of the qualification.

Unit	Learning outcome	Topics	Number of marks
350 Understand Land-based Service Engineering Calculations	LO1 Understand Land-based Service Engineering Calculations	1.1 Units of measure. 1.2 Unit of measure prefixes and rounding off 1.3 Unit of measure conversion factors 1.4 Relevant mathematical, engineering and scientific principles and formulae. 1.5 Use of charts and graphs and related calculations	24
352 Repair Land-based Compression-Ignition (Diesel) Engines	LO1 Understand land-based compression-ignition (diesel) engines.	1.1 The function and working principles of land-based compression-ignition (diesel) engines 1.2 Land-based compression-ignition (diesel) engine lubrication systems	12

		1.3 Land-based compression-ignition (diesel) engine cooling systems 1.4 Land-based compression-ignition (diesel) engine fuel systems 1.5 Land-based compression-ignition (diesel) engine emissions control systems	
353 Repair Land-based Spark-Ignition (Petrol) Engines	LO1 Understand land-based spark-ignition (petrol) engines	1.1 The function and working principles of land-based spark-ignition (petrol) engines 1.2 Land-based spark-ignition (petrol) engine lubrication systems 1.3 Land-based spark-ignition (petrol) engine cooling systems 1.4 Land-based spark-ignition (petrol) engine fuel systems 1.5 Land-based spark-ignition (petrol) engine emissions control systems.	12
		Total marks for sections:	48 marks
		Integration across units*:	12 marks
		<b>Total marks for exam: 60 Marks</b>	

\* *Integration across units.* These marks relate to Assessment Objective 4). These marks are awarded to differentiate between levels of performance by candidates taking the exam. The marks are given for how well a candidate has applied their knowledge, understanding and skills from across the units that make up the qualification in an integrated way to meet the requirements of the exam questions.



### 3. Guidance

#### Vocabulary of the exam: use of 'command' verbs

The exam questions are written using 'command' verbs. These are used to communicate to the candidate the type of answer required. Candidates should be familiarised with these as part of their exam preparation.

The following guidance has been produced on the main command verbs used in City & Guilds Technicals exams.

A more detailed version of this table, which also includes the command verbs used in the assignments is published in *City & Guilds Technical Qualifications Teaching, Learning and Assessment* guide.

Command verb	Explanation and guidance
<b>Analyse</b>	Study or examine a complex issue, subject, event, etc in detail to explain and interpret, elements, causes, characteristics etc
<b>Calculate</b>	Work out the answer to a problem using mathematical operations
<b>Compare</b> (... and contrast) (or <b>describe</b> the similarities/differences)	Consider and describe the similarities (and differences) between two or more features, systems, ideas, etc
<b>Define</b>	Give the meaning of, technical vocabulary, terms, etc.
<b>Describe</b>	Give a detailed written account of a system, feature, etc <b>(..the effect of...on...)</b> the impact, change that has resulted from a cause, event, etc <b>(..the process..)</b> give the steps, stages, etc
<b>Differentiate</b> between	Establish and relate the characteristic differences between two or more things, concepts, etc
<b>Discuss</b>	Talk/write about a topic in detail, considering the different issues, ideas, opinions related to it
<b>Distinguish</b> between	Recognise and describe the characteristic differences between two things, or make one thing seem different from another
<b>Evaluate</b>	Analyse and describe the success, quality, benefits, value, etc (of an end product, outcome, etc )
<b>Explain</b>	Make (a situation, idea, process, etc) clear or easier to understand by giving details, <b>(..how..)</b> Give the stages or steps, etc in a process, including relationships, connections, etc between these and causes and effects.
<b>Give example(s) illustrate/</b>	Use examples or images to support, clarify or demonstrate, an explanation, argument, theory, etc

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<b>Give a rationale</b>	Provide a reason/reasons/basis for actions, decisions, beliefs, etc
<b>Identify</b>	Recognise a feature, usually from a document, image, etc and state what it is
<b>Justify</b>	Give reasons for, make a case for, account for, etc decisions, actions, conclusions, etc, in order to demonstrate why they suitable for or correct or meet the particular circumstances, context
<b>Label</b>	Add names or descriptions, indicating their positions, on an image, drawing, diagram, etc
<b>List</b>	Give as many answers, examples, etc as the question indicates (candidates are not required to write in full sentences)
<b>Name</b>	Give the (technical) name of something
<b>Propose</b>	Present a plan, strategy, etc (for consideration, discussion, acceptance, action, etc).
<b>Select</b>	choose the best, most suitable, etc, by making careful decisions
<b>State</b>	Give the answer, clearly and definitely
<b>Summarise</b>	Give a brief statement of the main points (of something)

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## Question types

The following explains, and gives examples of, types of questions used in City & Guilds Technical exams. In preparing candidates to take the exam, it is recommended that you familiarise them with the requirements of each question type so that they can be effective and make best use of the time available when sitting the exam.

- An effective candidate will gauge the type and length of response required from the question and the number of marks available (which is given for each question on the exam paper).
- Short answer questions may not require candidates to write in complete sentences. Extended response questions will require a more developed response.
- Candidates should read the exam paper before attempting to answer the questions and should allocate time proportionate to the number of marks available for each question or section.

### Question type:

#### Short answer questions (restricted response)

These are questions which require candidates to give a brief and concise written response. The number of marks available will correspond to the number of pieces of information/examples and the length of response required by the question.

### Example question:

State the purpose of a hydrometer in relation to a lead acid battery.

#### Answer

1 mark for

- To measure specific gravity.

#### Structured Response Questions

These are questions that have more than one part (eg a), b), etc.). The overall question is made up of linked, short answer questions which move the candidate through the topic in a structured way. For example, the question will usually start with a 'recall'/'state'/'describe' question followed by an 'explain' to draw out understanding of the topic. They usually have a shared introductory 'stem', and the number of marks may increase through the question.

- a) Identify the formula that would be used to calculate the volume of an engine cylinder. (1 mark)

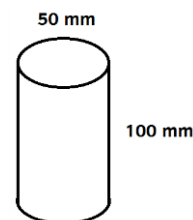


Figure 1

- b) Using the formula identified in a), calculate - in cubic centimetres - the capacity of the engine cylinder shown in Figure 1. Show all workings in your answer.

(2 marks)

#### Answer:

- a) 1 mark for correct formula:

- $\pi r^2 \times L$

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b) 1 mark for correct calculation, 1 mark for correct answer (in cm<sup>3</sup>/cc)

- $\pi 2.5^2 \times 10 = 196.35 \text{ cm}^3$

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### Extended response questions

Extended response questions are those that require the candidate to write a longer written response using sentences and paragraphs. These usually require candidates to discuss, explain, etc. a topic in some detail. The question is often based on a short case study, scenario or other prompt. The level of detail should be gauged from the question and the number of marks available.

You are currently working as an engineer in a land-based workshop facility. A tractor with a common rail diesel engine has been brought in as the customer has complained that it is down on power.

Discuss how you would determine the serviceability of the fuel system components. (12 marks)

### Indicative content

- Dynamometer test and compare results to manufacturer's specifications
- Monitor fuel system parameters with appropriate diagnostic tool
- Check condition of fuel
- Replace filters
- Clean water sedimentors
- Conduct low pressure test
- Injector leak off test
- Injector cut out test
- Clean fuel strainer

### Band 1 (1-4 marks)

The candidate has failed to identify many of the appropriate diagnostic checks. The candidate has provided minimal rationale for the checks they have proposed. The candidate's response may have frequently strayed from focusing on the fuel system components of a common rail diesel engine. The candidate will not have suggested any expected outcomes of their proposed checks for a serviceable fuel system.

### Example answer:

Firstly check the basic oil and coolant levels. Next check that there is enough diesel going into the cylinder. Do a compression test to see if all the cylinders are compressing the air correctly then if all of those things are ok, split the engine and check for a faulty head gasket. Next check to see if the injectors are functioning correctly. Check for the scores in liners and pistons. Check to see if the piston rings are all in correct working order. Replace any parts that may be worn or need replacing and rebuild the engine back together and re do the

compression tests to see if all cylinders are firing ok the check all fuel components again.

**Band 2 (5-8) marks)**

The candidate has proposed some of the diagnostic checks, but these may not be presented in a logical sequence. The candidate may have provided some reason for proposing certain checks. The candidate has largely focused on the fuel system components of a common rail diesel engine, but may have strayed into discussing other areas of the engine. The candidate is unlikely to have suggested expected outcomes of their proposed checks for a serviceable fuel system.

**Example answer:**

I would start off by looking over the whole fuel system, starting at the diesel tank, making sure that the lift pump is working correctly and has the correct pressure and the rock filter isn't blocked so that enough diesel is getting through, then move on to the diesel filter to make sure it is clean and not blocked to allow the diesel to go through. Along the way, check every pipe hose connection is on correctly and not leaking then move on to the right pressure diesel pump and check for leaks or damage, the at the top of the engine, check for leaks in the common rail or the pipes connected to the injectors. I would also check if the injectors are tightly in and not damaged. After that I would plug in the computer to the common rail to look for codes of errors and check that the common rail is at the correct pressure and that every injector is working correctly, at the right pressure and time. If that didn't help I would remove the injectors and test the spray pattern is correct and that the nozzles are not blocked with soot. Also, carry out the compression test on each of the cylinders. Also, check with the computer if the injectors are putting out the correct amount of diesel as it might be getting too much or too little diesel.

**Band 3 (9-12 marks)**

The candidate has proposed most (if not all) of the diagnostic checks, and in a logical sequence. The candidate has provided clear reasons why they have proposed each check. The candidate has remained focused on the fuel system components of a common rail diesel

engine. The candidate has (where applicable) suggested expected outcomes of their proposed checks for a serviceable fuel system.

**Example answer:**

Firstly, I would speak to the customer to find out if any work had been carried out recently that could have affected the power output of the machine. I would then connect the appropriate diagnostic tool and check for error codes. If error codes were present I would make a note of them and then clear them. Once cleared I would run the machine to see what codes come back. With the diagnostic tool connected, I would log fuel system parameters ready to conduct a dynamometer test to verify the issue. The parameters would include fuel metering valve, fuel temperature, rail pressure and injection rates. I would then conduct a dynamometer test to verify if the machine is down on power comparing against manufacturer's specification and diagnostic tool parameters. If the above tests didn't lead me to the possible cause, I would start an inspection of the fuel system. Firstly, I would replace the fuel filters due to the low cost of the items. I would then check the fuel in the tank and sedimentor for contamination and water. Working from the fuel tank back, I would remove, inspect and clean the fuel strainer in the tank. Then continuing along the system, I would check for damage or signs of leaks in the pipes and surrounding components. If there were no obvious signs of damage or leaks, I would then conduct a low-pressure test of the fuel system. This would help in the diagnosis of the low-pressure side of the common rail fuel system. Included in the low pressure testing would be a leak off test of the injectors. All low-pressure fuel system checks would be conducted in accordance with manufacturer's specification. Finally, using the appropriate diagnostic tool I would conduct an injector cut out test to verify if all injectors are working in accordance with the manufacturer's specification. Whilst conducting the injector cut out test, I would be listening for engine note changes and a change in the injected fuel quantities observed through the diagnostic tool. If an injector was cut out and the engine note/injected fuel quantity didn't change, this would lead me to a faulty injector. The fault with the injector could be either mechanical or electrical. The solenoid coil could have failed causing the cylinder to misfire, or the injector

could be mechanically stuck closed. Both faults would have been highlighted during the leak off testing conducted earlier. If all checks indicated a fully serviceable fuel system, I would then conduct a compression test of each cylinder.

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## Examination technique

Candidates with a good understanding of the subject being assessed can often lose marks in exams because they lack experience or confidence in exams or awareness of how to maximise the time available to get the most out of the exam. Here is some suggested guidance for areas that could be covered in advance to help learners improve exam performance.

### Before the exam

Although candidates cannot plan the answers they will give in advance, exams for Technical qualifications do follow a common structure and format. In advance of taking the exam, candidates should:

- be familiar with the structure of the exam (ie number and type of questions).
- be aware of the amount of time they have in total to complete the exam.
- have a plan, based on the exam start and finish time for how long to spend on each question/section of the exam.
- be aware of how many marks are available for each question, how much they should expect to write for each question and allow most time for those questions which have the most marks available.

### At the start of the exam session

At the start of the exam, candidates:

- should carefully read through the instructions before answering any questions.
- may find it helpful, where possible, to mark or highlight key information such as command words and number of marks available on the question paper.
- identify questions which require an extended written answer and those questions where all or part of the question may be answered by giving bullets, lists etc rather than full sentences.

### Answering the questions

Candidates do not have to answer exam questions in any particular order. They may find it helpful to consider, for example:

- tackling first those questions which they find easiest. This should help them get into the 'flow' of the exam and help confidence by building up marks quickly and at the start of the exam.
- tackling the extended answer question at an early stage of the exam to make sure they spend sufficient time on it and do not run out of time at the end of the exam.

Candidates should avoid wasting time by repeating the question either in full or in part in their answer.

Candidates should **always** attempt every question, even questions where they may be less confident about the answer they are giving. Candidates should be discouraged however, from spending too long on any answer they are less sure about and providing answers that are longer and give more detail than should be necessary in the hope of picking up marks. This may mean they have less time to answer questions that they are better prepared to answer.

### Extended answer questions

Before writing out in full their answer to extended questions, candidates may find it helpful to identify the key requirements of the question and jot down a brief plan or outline of how they will answer it. This will help clarify their thinking and make sure that they don't get 'bogged down' or provide too much detail for one part of the question at the expense of others.



## **Towards the end of the exam**

Candidates should always set aside time at the end of the exam to read back through and review what they have written in order to make sure this is legible, makes sense and answers the question in full.

If a candidate finds they are running out of time to finish an answer towards the end of the exam, they should attempt to complete the answer in abbreviated or note form. Provided the content is clear and relevant, examiners will consider such answers and award marks where merited.

Further guidance on preparing candidates to take the exam is given in the City & Guilds publication, [Technical Qualifications, Teaching, Learning and Assessment](#) which can be downloaded free of charge from City & Guilds website.

## 4. Further information

For further information to support delivery and exam preparation for this qualification, centres should see:

### City & Guilds

Qualification homepage: <http://www.cityandguilds.com/qualifications-and-apprenticeships/land-based-services/agriculture/0171-technical-in-agriculture-and-landbased-engineering#tab=information> which includes:

- Qualification handbook
- Synoptic Assignment
- Sample assessments

*Technical Qualifications, Resources and Support: [cityandguilds.com/techbac/technical-qualifications/resources-and-support](http://cityandguilds.com/techbac/technical-qualifications/resources-and-support)*

### Joint Council for Qualifications

*Instructions for Conducting Examinations: <http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>*