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ENGINEERING

Unit 8

Optimise and maintain performance in engineering systems

Model assignment

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Contents

Please note:

You can use this assignment to provide evidence for summative assessment, which is when the learner has completed their learning for this unit and is ready to be assessed against the grading criteria.

You can use this assignment as it is, or you can modify it or write your own; we give more information in this document under Guidance for tutors.

Guidance for tutors on using this assignment

General

OCR Cambridge Technical model assignments are available to download from our website: www.ocr.org.uk.

The purpose of this assignment is to provide a scenario and set of tasks that are typical of how engineers optimise performance through maintaining engineering systems and products to enable you to assess your learner against the requirements specified in the grading criteria. The scenario and its tasks are intended to give a work-relevant reason for applying the skills, knowledge and understanding needed to achieve the unit.

This assignment will not instruct learners how to meet the highest grade. Whether learners achieve a pass, merit or distinction will depend on what evidence they produce.

You can modify the scenario we provide in this assignment to make it more relevant to your local or regional needs. Please refer to the information under 'Modifying the model assignment' later in this section.

You don't have to use this assignment. You can use it as a guide to help you to design your own assignment, and we provide an assignment checking service. You'll find more information on these matters in section 8 of the qualification handbook.

In the tasks, we'll refer to the format of evidence. Learners are **not** required to follow that format **unless** we tell them otherwise.

It's essential that the work every learner produces is their own. Please make sure you read through the information we give on authenticity in section 8 of the qualification handbook and make sure that your learners and any staff involved in assessment understand how important authenticity is.

We provide this assignment to be used for summative assessment. You must not use it for practice or for formative assessment.

Before using this assignment to carry out assessment

Learners will need to take part in a planned learning programme that covers the knowledge, understanding and skills of the unit.

When your learners are ready to be assessed, they must be provided with a copy of the following sections of this assignment:

- General information for learners
- Assignment for learners
- Evidence Checklist

They may carry out preparation prior to undertaking the tasks and there is no time limit for this.

When completing the assignment

You should use this assignment in conjunction with the unit specification and qualification handbook.

Resources to complete the tasks

There are resource requirements for this assignment. Every learner will need access to the following resources:

- Suitable portable power tool powered by a small petrol engine.
- Technical data for the power tool e.g. torque settings and clearances.
- Health and Safety regulations, standards and codes of practice and a safe working environment.
- Appropriate personal protective equipment (PPE)
- Data sets of key components for calculating MTBF/MTTF/MTTR
- Manufacturer's instructions for maintenance procedures and system checks.
- Tools including any specialist tools unique to the power tool, measuring and diagnostic equipment.
- Replacement serviceable items appropriate for the power tool.

Tutor information to support the tasks

You may want to give a general introduction to the function of the power tool chosen for this assignment.

Observation and witness statements can be a useful way of providing support and corroboration of learner-generated evidence and skills which are not easily represented in the portfolio of evidence (see the section on Internal Assessment in the Qualification handbook, and in particular the section on the use of witness statements).

In task 2, for M1 learners will require access to data and for D1 they will need to use this data to determine the reliability of components. You will need provide appropraite data sets for a range of components in the chosen power tool (centre devised or if available from manufactures technical data). The data could be presented to learners in the form of a spreadsheet. For each component you should provide between 25 and 30 different failure times so that learners can individually use this information to calculate MTBF/MTTF/MTTR and present relibiity data (see unit specification 2.1 and 2.2).

In task 3, you will need to provide learners with appropriate servicing and maintence records so they can indiviually record maintence procedures and system checks.

In task 4, learners need to perform an unscheduled repair on a system that has prematurely failed. It may not therefore be appropriate to use the power tool they have previously used in tasks 1-3.

You will therefore need to provide a system either mechanical, electrical or fluid power with a known or introduced failure for learners to individually investigate and identify. To ensure individual candidate work in this task you may need to introduce different failures on different systems, or different failures on the same system in either case technical data should be made available to enable learners to perform system tests, identify the system failure and its cause and perform a repair.

Health and Safety and the use of resources

Health and safety will need to be considered should any of the tasks, or parts of the tasks be undertaken as practical activities. This should include appropriate risk assessments, safe working methods statements and the use of appropriate personal protective equipment (PPE). Learners should be encouraged to take part in assessing risk before conducting any practical activity.

Time

You should plan for learners to have 14–19 hours to complete this assignment.

Learners must be allowed sufficient time to complete all the tasks. The amount of time may vary depending on the nature of the tasks and the ability of individual learners. To help with your planning, against each of the tasks we've given an indication of how long it should take.

Learners can produce evidence in several sessions.

Format of evidence

Learners have to produce evidence that demonstrates how they have met the grading criteria. At the very least they must produce evidence that meets **all** of the pass criteria.

Please make sure your learners realise that missing just one pass criterion means they will not pass the unit, even if they have successfully met the merit and distinction criteria.

We don't have specific requirements for the format of evidence in this assignment. We've said what format the evidence could take for each task. For example, if we say 'You could include a report on …', the evidence doesn't have to follow any specific reporting conventions. You can modify the format of the evidence, but you must make sure the format doesn't prevent the learner from accessing the grading criteria.

It's possible that certain formats for evidence can naturally cover several grading criteria and avoid the need for excessive amounts of evidence. For example, a report can be a good way to pull together evidence to meet several grading criteria.

For more guidance on generation and collection of evidence, please refer to the section 8 'Internal Assessment', in the qualification handbook.

Group work

This assignment hasn't been written to include group work. If you plan to ask learners to work in a team to complete work for assessment, you need to determine at which point in an assessment task learners can work together.

You must be sure that each learner can produce evidence of their own contribution to each grading criterion. You can give constructive feedback to learners about working as a group and direct them on team working skills because evidence of team working skills is not required by the unit. See our information on authentication, including group work and feedback to learners, in section 8 of the qualification handbook.

If witness statements are used to support learners' evidence, you'll need to complete an individual statement for each learner.

After completing the assignment

Once the learner has submitted their work to you to be assessed, you must judge or 'mark' the work against the grading criteria for the unit and identify one grade for the unit. For further information about assessment, please refer to section 8 of the qualification handbook.

Your assessment decisions must be quality assured across the cohort of learners in your centre who are being entered for the same unit. This must be done through an internal standardisation process. We give information on internal assessment and standardisation in the qualification handbook.

Reworking the assignment

If you and the learner feel they've not performed at their best during the assessment, the learner can, at your discretion, improve their work and resubmit it to you for assessment. If a learner is working on improving their work before it is resubmitted, you and the learner must continue to make sure the work is the learner's own.

Any feedback you give to the learner must not direct them on how to improve their work. You can identify what area of the work could be improved but you cannot give the learner any details about how they could improve it. You must follow the guidelines given in section 8 of the qualification handbook under 'Authenticity of learner work'.

Modifying the model assignment

The tasks in this assignment allow learners access to the full range of grades detailed in the grading criteria of this unit.

If you modify this assignment you must **not** change the grading criteria provided in the tasks for the learner or in the evidence checklist. These grading criteria are taken from the unit.

You can modify the scenario to suit your local or regional needs and the tasks may be contextualised to match any changes you have made to the scenario. If you supply your own drawings to support a different scenario, these must be sufficiently detailed for learners to complete the tasks.

You can modify the type of evidence and the format it takes, unless we expressly state that evidence must take a specific format.

You must also make sure that you avoid discrimination, bias and stereotyping and support equality and diversity. For more information, please see the section 'Designing your own assignments for internally assessed units' in section 8 of the qualification handbook.

If modifications are made to the model assignment, whether to the scenario alone, or to both the scenario and individual tasks, it's your responsibility to make sure that all grading criteria can still be met and that learners can access the full range of grades.

If you're using this model assignment and delivering the Diploma you have an opportunity to secure meaningful employer involvement by working with an employer to modify it.

General information for learners

Q ***What do I need to do to pass this assignment?***

A You need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to. If you miss just one pass criterion, you will not achieve this unit and will receive an unclassified result.

Q ***What do I need to do if I want to get a merit or distinction for this assignment?***

A For a merit, you need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to **and** you need to produce evidence to meet **all** the merit criteria.

For a distinction, in addition to the above, you also need to meet **all** the distinction criteria for this unit.

Q ***What help will I get?***

A Your tutor will support you when completing this assignment and will make sure that you know what resources or facilities you need and are allowed to use. We've given your tutor information about how much support they can give you.

Q ***What if I don't understand something?***

A It's your responsibility to read the assignment carefully and make sure you understand what you need to do and what you should hand in. If you are not sure, check with your tutor.

Q ***I've been told I must not plagiarise. What does this mean?***

A Plagiarism is when you take someone else's work and pass this off as your own, or if you fail to acknowledge sources properly. This includes information taken from the internet.

It's not just about presenting a whole copied assignment as your own; you will also be plagiarising if you use the ideas or words of others without acknowledgement, and this is why it's important to reference your work correctly (see Q&A below for more information on referencing).

Plagiarism has serious consequences; you could lose the grade for this unit or you may not be allowed to achieve the whole qualification.

Always remember that the work you produce must be your own work. You will be asked to sign a declaration to say that it is.

Q ***What is referencing and where can I find out more information about it?***

A Referencing is the process of acknowledging the work of others. If you use someone else's words and ideas in your assignment, you must acknowledge it, and this is done through referencing.

You should think about why you want to use and reference other people's work. If you need to show your own knowledge or understanding about an aspect of subject content in your assignment, then just quoting and referencing someone else's work will not show that **you** know or understand it. Make sure it's clear in your work how you are using the material you have referenced **to inform** your thoughts, ideas or conclusions.

You can find more information about how to reference in *The OCR Guide to Referencing* available on our website: http://www.ocr.org.uk/Images/168840-the-ocr-guide-to-referencing.

Q ***Can I work in a group?***

A Yes. However, if you work in a group at any stage, you must still produce work that shows your individual contribution. Your tutor can advise you how to do this.

Q ***Does my work for each task need to be in a particular format?***

A You can present your work in a variety of ways – it can be handwritten, word-processed, on video or in digital media. What you choose should be appropriate to the task(s) and your tutor can advise you. There may be times when you need proof that you have completed the work yourself: for example, if you do something during work placement that you want to use as evidence, the tutor might ask the employer to provide a witness statement.

Make sure you check the wording in each task carefully. For each task, we'll tell you if your evidence has to be in a specific format:

- If we say use the word '**must**', for example 'You must produce a report' or 'Your evidence/work must include a diagram', then you must produce the work in the stated format.
- If we use the word '**could**', for example 'You could include sketches of your ideas' or 'You could do this by annotating your diagram', this means that you are not required to follow the format we have given, but you must make sure that the work you do produce allows you to demonstrate the requirements of the grading criteria.

If you are unsure about what evidence you need, please ask your tutor.

Q ***Can I ask my tutor for feedback on my work?***

A Yes, but they can't give you detailed feedback.

We have given your tutor instructions on what kind of feedback they can give you. For example, they are **not** allowed to tell you exactly what to do to make your work better, but they **can** remind you about what they've taught you and you can use this additional learning to try and improve your work independently. They can say what they've noticed might be wrong with your work, for example if your work is descriptive where an evaluation is required, but your tutor can't tell you specifically what you need to do to change it from a description to an evaluation – you will need to work out what you need to do and then do it for yourself.

Q ***When I have finished, what do I need to do?***

A If you have included the personal details (such as name, address or date of birth) of someone other than yourself in your work, this must be blanked out (anonymised) – your tutor will tell you how to do this. You don't need to do this for information contained in references.

You can complete the evidence checklist to show your tutor where they can find the evidence for each grading criterion in your work.

You should make sure your work is labelled, titled and in the correct order for assessing.

Hand in the work that you've completed for each task to your tutor. They might ask to see your draft work, so please keep your draft work in a safe place.

Q ***How will my work be assessed?***

A Your work will be marked by someone in your centre who has been authorised to do so. They will use the information in the grading criteria to decide which grade your work meets. The grading criteria are detailed in each unit and are also given in the tasks within this assignment. Please ask your tutor if you are unsure what the grading criteria are for this assignment.

Assignment for learners
Unit 8: Optimise and maintain performance in engineering systems

Scenario

Portable power equipment

Portable power tools such as generators, compressors, cement mixers, lawn mowers and chain saws are often powered by small petrol engines.

Regular inspection, servicing and maintenance is essential to ensure optimum performance is maintained.

Power tools that do not function as intended can be dangerous and costly to the user.

You are to construct an inspection and maintenance schedule for the petrol engine of a portable powered tool, and then use your schedule to perform maintenance procedures to ensure that the petrol engine operates at its optimum performance.

Task 1: Maintenance and repair

(This task should take between 3 and 4 hours.)

Learning Outcome 1: 'Understand the importance of maintenance to optimise performance' is assessed in this task.

You first task is to research different types of maintenance programmes appropriate for product(s) that use mechanical, electrical and fluid power systems.

Your second task is to explain the reasons for maintenance.

Your third task is to illustrate the implications of not maintaining an engineered system or product correctly.

Pass	**Merit**	**Distinction**
P1: Explain the reasons for maintenance and repair and the implications of not maintaining an engineering system or product.		
Evidence		
Your evidence could be in the form of a written report.		

Task 2: Scheduled maintenance planning

(This task should take between 4 and 5 hours.)

Learning Outcome 2: 'Be able to plan maintenance to optimise performance' is assessed in this task.

Your task is to prepare a plan of maintenance tasks that would be part of a scheduled maintenance plan for the petrol engine of a portable powered tool.

You will review your chosen power tool to identify the type of maintenance required for the petrol engine's key components such as drive belts, chains and poppet valves and prepare a plan to schedule maintenance for these components to include:

- sequence of operation of maintenance
- maintenance frequency.

Your scheduled maintenance plan could be supported by using reliability data. Your tutor will provide you with data sets of key components so you can use this data to inform your scheduled maintenance plan to maintain or improve your engine's reliability. You could also show how you would use calculations to determine reliability of the key components in the engine to inform your maintenance plan.

Pass	**Merit**	**Distinction**
P2: Prepare a sequence of maintenance tasks as part of a scheduled maintenance plan.	M1: Use data to produce a scheduled maintenance plan to maintain or improve system reliability.	D1: Use calculations to determine reliability of systems or components to inform a maintenance strategy.
Evidence		
You must produce a maintenance schedule. You could annotate your maintenance schedule to show how you have used data to maintain or improve system reliability. You could use calculations of MTBF/MTTF/MTTR to inform a maintenance schedule and produce a strategy report showing calculations and findings.		

Task 3: Perform safe maintenance procedures

(This task should take between 4 and 6 hours.)

Learning Outcome 3: 'Be able to perform maintenance operations' is assessed in this task.

For your chosen petrol engine you will set up for **and** safely perform maintenance procedures and system checks ensuring that servicing and maintenance records are completed.

You could also show how you have performed the inspection and replacement of selected serviceable items in your petrol engine, such as a timing belt or chain, showing where you have made any necessary adjustments.

You may use diagnostic (testing) equipment to confirm expected values to inform or provide advice on serviceable items.

Pass	**Merit**	**Distinction**
P3: Work safely to perform maintenance procedures and system checks using manufacturer's instructions. Complete servicing and maintenance records.	M2: Perform inspection and replacement of serviceable items using manuals, making adjustments where necessary.	D2: Use diagnostic equipment to obtain data to confirm expected values. Provide advice on serviceable items requiring attention and any changes in maintenance frequency.
Evidence		
You must demonstrate how you have prepared for safe and effective practical activity. You could list necessary safe working practices and procedures and identify and record potential risks to self and others (e.g. a risk assessment). Your evidence of practical activities could be in the form of video footage supported by accompanying notes or annotated photographs. You should include a witness statement from your tutor detailing how you have worked safely. You must provide a written record of your completed servicing and maintenance records. You should include data sheets, screen shots and printouts to support diagnostic tests and include a written report of advice provided or changes made as a result of these test.		

Task 4: System failure, testing and repairs

(This task should take between 4 and 6 hours.)

Learning Outcome 4: 'Be able to perform unscheduled repair procedures' is assessed in this task.

Your tutor will provide you with a system that has prematurely failed for this task.

You will investigate the system to identify where the failure has occurred using fault finding techniques and perform the necessary procedures to repair it.

You could then analyse the cause of the premature failure to report on why it occurred. You should use test data to analyse the cause of the premature failure in the system, comparing the recorded data against expected or specified values.

Pass	**Merit**	**Distinction**
P4: Perform system tests to identify cause of system failure and perform repairs.	M3: Analyse the cause of a premature failure in an electrical, mechanical or fluid power system.	
Evidence		
Your evidence should be in the form of photographs or video footage with accompanying annotations/notes showing how you have performed fault finding techniques and identifying probable causes of component/system failure. You could record your findings in a report that details the causes of premature failure in the system. Your evidence of the analysis of the cause of a premature failure should be in the form of a written report or presentation (including detailed speaker notes) that includes data that you have gathered and used.		

Evidence Checklist

OCR Level 2 Cambridge Technicals in Engineering Unit 8: Optimise and maintain performance in engineering systems

LEARNER NAME:

For Pass have you: **(as a minimum you have to show you can meet every pass criterion to complete the unit)**	**Where can your tutor find the evidence? Give page no(s)/digital timings, etc.**
P1: Explained the reasons for maintenance and repair and the implications of not maintaining an engineering system or product?	
P2: Prepared a sequence of maintenance tasks as part of a scheduled maintenance plan?	
P3: Worked safely to perform maintenance procedures and system checks using manufacturer's instructions. Completed servicing and maintenance records?	
P4: Performed system tests to identify cause of system failure and perform repairs?	

For Merit have you:	**Where can your tutor find the evidence? Give page no(s)/digital timings, etc.**
M1: Used data to produce a scheduled maintenance plan to maintain or improve system reliability?	
M2: Performed inspection and replacement of serviceable items using manuals, making adjustments where necessary?	
M3: Analysed the cause of a premature failure in an electrical, mechanical or fluid power system?	

For Distinction have you:	**Where can your tutor find the evidence? Give page no(s)/digital timings, etc.**
D1: Used calculations to determine reliability of systems or components to inform a maintenance strategy?	
D2: Used diagnostic equipment to obtain data to confirm expected values. Provided advice on serviceable items requiring attention and any changes in maintenance frequency?	

To find out more
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or call our Customer Contact Centre on **02476 851509**

Alternatively, you can email us on **vocational.qualifications@ocr.org.uk**

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