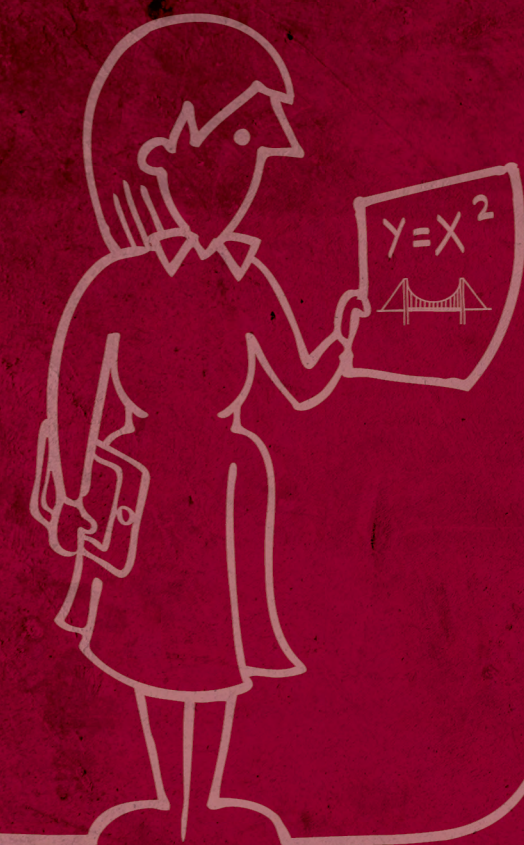




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CAMBRIDGE NATIONALS IN ENGINEERING

R112 - QUALITY CONTROL OF ENGINEERED
PRODUCTS

DELIVERY GUIDE

VERSION 1

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To give us feedback on, or ideas feedback text the OCR resources you have used, email resourcesfeedback@ocr.org.uk

OCR Resources: the small print

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources.

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INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic. The Guide is structured by learning objective so you can see how each activity helps you cover the specification.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning opportunities.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning opportunities.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resourcesfeedback@ocr.org.uk.

PLEASE NOTE

The activities suggested in this Delivery Guide **MUST NOT** be used for assessment purposes. (This includes the Consolidation suggested activities).

The timings for the suggested activities in this Delivery Guide **DO NOT** relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from www.ocr.org.uk.

The latest version of this Delivery Guide can be downloaded from the OCR website

OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.

KEY



English



Maths

UNIT R112 – QUALITY CONTROL OF ENGINEERED PRODUCTS

Guided learning hours : 30

PURPOSE OF THE UNIT

This unit will develop learners' knowledge and understanding of techniques and procedures used to ensure the quality of engineered products. Learners will be required to produce and carry out a detailed set of procedures for the quality control of engineered products which will be used in a 'real world' situation involving high-volume manufacture of products. Learners will also gain an understanding of the principles of lean manufacture and how they are applied to improving the quality of the manufacturing process.



On completion of this unit, learners will understand the techniques and procedures used to ensure the quality of engineered products.

| Learning Outcome — The learner will: |
|---|
| LO1: Understand the importance of quality control |
| LO2: Be able to assess product quality from inspection and quality control techniques |
| LO3: Know how modern technologies can be used in quality control |
| LO4: Know the principles of lean manufacturing |

LO1 - UNDERSTAND THE IMPORTANCE OF QUALITY CONTROL

Learning Outcome — The learner will:





LO1: Understand the importance of quality control

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|--|--|-------------------|-----------------------|
| 1 Reasons for implementing quality control in production  | <p>The reasons for implementing quality control during production could be seen by learners in action if the teacher is able to arrange an industrial visit. It could alternatively be explored as a research activity by learners to include: early intercept of production problems, waste management, consistency, cost reduction, conformity and reduced returns. Learners could present their findings as a presentation or a poster. The following videos showing quality in action could be used as an introduction:</p> <p>https://www.youtube.com/watch?v=ypZiSguq4jM https://www.youtube.com/watch?v=HAQirqw3NWw</p> | 2 hours | R108 |
| 2 Quality procedures  | <p>Quality procedures used in practice including quality control, quality standards, quality assurance and total quality management could also be seen during an industrial visit or explored by learners as a research activity. Learners could compare the key features of each approach to quality and summarise the advantages and disadvantages of each type. Web-based resources may prove useful – the following website of the Chartered Quality Institute (CQI) contains useful information and case studies:</p> <p>http://www.thecqi.org/Knowledge-Hub/Resources/Factsheets/Total-quality-management/ See Lesson Element: Quality procedures.</p> | 2 hours | R108 |

LO2 - BE ABLE TO ASSESS PRODUCT QUALITY FROM INSPECTION AND QUALITY CONTROL TECHNIQUES

Learning Outcome — The learner will:





LO2: Be able to assess product quality from inspection and quality control techniques


| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|--|--|-------------------|-----------------------|
| 1 Quality control techniques used in production  | Teachers will most likely adopt a practical approach to quality techniques throughout this learning outcome introducing learners to appropriate theory where required. Teachers could begin by introducing: application of tolerance, sampling techniques, comparison methods and methods for determining related corrective actions. Web-based resources could prove useful in explaining quality control techniques eg the following video shows TATA quality control procedure for monitoring defects using a check sheet (introduction): https://www.youtube.com/watch?v=3TV4xFGleEE . See Lesson Element: Quality control techniques used in production. | 2 hours | R110 |
| 2 Applications of inspection checks  | Learners could undertake visual quality control checks on real components if available. This could include visual checks of surface finish and comparison with some reference point or standard. Learners could undertake a visual inspection and comparison of components or parts that they have produced themselves elsewhere by hand or machine. | 2 hours | R110 |
| 3 Use of inspection equipment  | Teachers could introduce learners to a range of different measuring equipment required to undertake quality control checks and measurements including: micrometer, digital vernier calliper, gauges, comparators (eg jigs, fixtures and master components). More advanced inspection techniques including x-ray and ultrasonic testing will most likely be presented as case studies using suitable resources. Learners will most likely be able to undertake practical measurement and checks on real components or parts. | 4 hours | R110 |
| 4 Evaluating products from quality control checks  | Teachers could introduce learners to a range of techniques for evaluating products using quality control checks, and this could relate to actual components or parts supplied to or manufactured by learners. These could include: comparison against specification, determining precision and accuracy in manufacturing processes, evaluating quality of outcome, comparing measurement (eg important dimensions; datum edges and faces) and undertaking safety checks (eg consumer safety, non-destructive tests). Some or all of these could be undertaken practically by learners or through case studies or demonstrations. Learners may be able to undertake a complete quality check and evaluation process for a number of components, and present their findings. | 5 hours | R110 |

LO3 - KNOW HOW MODERN TECHNOLOGIES CAN BE USED IN QUALITY CONTROL

Learning Outcome — The learner will:

LO3: Know how modern technologies can be used in quality control





| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|--|-------------------|-----------------------|
| 1 Modern quality control techniques: non-destructive testing and 3D scanning  | An industrial visit, if possible, could be a useful way of learners being able to see modern inspection techniques used in quality control in action throughout this learning outcome. Alternatively, web-based resources could be used by teachers to show non-destructive such as: visual inspection, ultrasonic testing, dye penetrant testing and x-ray crack testing. The British Institute of Non-destructive Testing (BINDT) website contains lots of useful information and videos: http://www.bindt.org/ . The following video shows 3D ultrasonic scanning of a weld: https://www.youtube.com/watch?v=q4wh0KCKL48 . | 2 hours | R109 |
| 2 Modern quality control techniques: CNC measurement checks  | Learners could be introduced to CNC measurement checks through an industrial visit, or through the use of suitable resources (some of which could be web based). The following video shows CNC co-ordinate measurement taking place: https://www.youtube.com/watch?v=844UiRBVxIY . Teachers could set learners a research activity to explore a number of modern quality control techniques resulting in a presentation or poster of findings. | 1 hour | R111 |
| 3 Modern quality control techniques: robotics  | Similarly, learners could be introduced to robotics in quality control through suitable videos. The following show robots being used in quality control operations. Both include some element of computerised vision for the detection of faults and robotics to select and move components: https://www.youtube.com/watch?v=MmjAFsKdVcE https://www.youtube.com/watch?v=bPd7l1_6ws0 . Learners could undertake more detailed research of the different applications of robotics in quality control. | 1 hour | R111 |
| 4 Modern quality control techniques: CIE and CIM  | Learners could undertake a research activity to find out what Computer Integrated Engineering (CIE) and Computer Integrated Manufacture (CIM) are, and to highlight the key features of each. They may discover that both terms are often used interchangeably. Web resources could prove a useful starting point such as the following website that explains CIM: http://www.technologystudent.com/rmprp07/intman1.html . Learners could present their findings in diagrammatic or pictorial form – which could be as a poster. | 2 hours | |

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|--|---|-------------------|-----------------------|
| 5 Modern quality control techniques: automatic inspection  | <p>It could be possible for learners to see automatic inspection in use during an industrial visit or through the use of suitable videos eg the following shows electronic circuit test using automatic test equipment (ATE): https://www.youtube.com/watch?v=YegtDW42peg.</p> <p>Learners could research the reasons for using ATE and explore a range of automatic test equipment for different applications (including electrical and mechanical).</p> | 1 hour | |

LO4 - KNOW THE PRINCIPLES OF LEAN MANUFACTURING

Learning Outcome — The learner will:

LO4: Know the principles of lean manufacturing

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|--|--|-------------------|-----------------------|
| 1 Causes of waste in manufacture  | Causes of waste in manufacture include time, materials, resources, processes, supply, and space. The teacher could begin by introducing the subject of waste to learners and then task learners to explore examples of where these could occur in practice and how they could be minimised. | 1 hour | R105 |
| 2 Categories of waste (7 lean wastes)  | Lean wastes can be categorised into 7 categories: transportation, inventory, movement, waiting, over-processing, overproduction, and defects. These are often referred to by the acronym 'TIMWOOD'. Suitable web-based resources (such as the following video) could prove useful in explaining TIMWOOD to learners: https://www.youtube.com/watch?v=8gExNBPzSJk . See Lesson Element: Categories of waste (7 lean wastes). | 2 hours | R105 |
| 3 Methods of reducing waste: DFMA  | Waste reduction is often achieved through Design for Manufacturing Assembly (DFMA) ie use of common fixing strategy, standardised components, complexity reduction, make versus buy, handling and processing. The teacher could use suitable web-based resources to explain DFMA with the following website containing real DFMA case studies that could be analysed: http://www.dfma.com/resources/studies.htm . | 2 hours | R105 |
| 4 Methods of reducing waste: sustainable design  | Teachers could introduce learners to sustainable design through explaining life cycle analysis (LCA) including material reduction, end-of-life disposal and recycling of materials. Web-based resources could be useful in explaining these. The following explains Life Cycle Analysis (LCA): http://www.powerhousemuseum.com/ecologic/resources/lesson-plans-worksheets/lesson-plan-product-life-cycle-analysis/#worksheet . Learners could be given an activity, working in groups, to develop a LCA for an everyday product, such as the newspaper or mobile phone. The following website gives a graphical representation of such examples, and may prove useful: http://www.technologystudent.com/prddes1/lifecy1.html . | 1 hour | R105 |

POSSIBLE INTERNET SOURCES

| Source | Website |
|--|--|
| Chartered Quality Institute (CQI) | www.thecqi.org |
| British Institute of Non-destructive Testing | www.bindt.org |
| YouTube | www.youtube.com |
| Technology Student | www.technologystudent.com |
| Powerhouse Museum | www.powerhousemuseum.com |

Contact us

Staff at the OCR Customer Contact Centre are available to take your call between 8am and 5.30pm, Monday to Friday.

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