2016 Suite

OCR
Oxford Cambridge and RSA

Cambridge **TECHNICALS LEVEL 3**

Cambridge TECHNICALS 2016

ENGINEERING

Unit 19

Inspection and testing

Y/506/7285

Guided learning hours: 60

VERSION 4 -June 2017 black line indicates updated content

LEVEL 3

UNIT 19: INSPECTION AND TESTING

Y/506/7285

Guided learning hours: 60

Essential resources required for this unit: **none**

This unit is internally assessed and externally moderated by OCR.

UNIT AIM

In ensuring that the business can meet the demands of its customers when manufacturing and supplying goods, suppliers must inspect and test these goods and products prior to completion, to guarantee their levels of quality. Dependent on the product type and process used to manufacture, there are a number of methods which can be used.

The aim of this unit is for learners to develop an understanding of different methods of inspection and testing (including both destructive and non-destructive testing). They will learn how the use of these methods contributes to quality control, and how defects can form in manufacturing components, processes and materials in the first place.

They will also learn about how automatic testing and inspection techniques are used in engineering.

TEACHING CONTENT

The teaching content in every unit states what has to be taught to ensure that learners are able to access the highest grades.

Anything which follows an i.e. details what must be taught as part of that area of content. Anything which follows an e.g. is illustrative, it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, although these do not need to be the same ones specified in the unit content.

For internally assessed units you need to ensure that any assignments you create, or any modifications you make to an assignment, do not expect the learner to do more than they have been taught, but must enable them to access the full range of grades as described in the grading criteria.

Please note – if learners are completing this unit as part of the Extended Diploma qualification they will be required to complete the synoptic unit 25: Promoting continuous improvement. Before your learners complete the assessment of this unit, you must refer to the specification and model assignment requirements for unit 25, so if applicable you can ensure learners gather the appropriate feedback on their own performance and performance of the system, process or artefact that they may have produced in this unit.

Learning outcomes	Teaching content
The Learner will:	**Learners must be taught:**
1. Understand how inspection and testing methods and processes improve quality control	1.1 how inspection and testing methods are used to minimise quality issues, i.e. • Production Parts Approval Process (PPAP) used to ensure processes are capable of meeting the customers' needs prior to mass production • First Off and Last Off inspection (FOLO) Batch work control method 1.2 how Statistical Process Control (SPC) is used to minimise quality issues 1.3 how SPC moving range charts are produced and used 1.4 how to schedule inspection and testing methods and processes to improve quality control
2. Understand how defects can occur in manufacturing materials, processes and components	2.1 the types of defects that can occur in materials, their causes and effects, i.e. • cracking • lamination • segregation • shrinkage • porosity • inclusions (because of impurities in the base metal) 2.2 the type of defects that occur in different manufacturing processes, i.e. • forging (e.g. scale pits) • casting (e.g. pouring defect) • welds (e.g. porosity caused by welded surface not being clean) • coatings (e.g. wrinkling) 2.3 in-service defects that can occur in different manufactured components, i.e. • types (e.g. fatigue, wear) • causes and effects • relationship with material and manufacturing process defects
3. Understand how destructive testing methods are used for quality assurance in manufacturing	3.1 which type of material or component each destructive testing method is suitable for 3.2 the advantages and limitations of each destructive testing method 3.3 destructive testing methods i.e. • Charpy Notch test – impact tester – high strain-rate test (which determines the amount of energy absorbed by a material during fracture) • tensile testing • Vickers, Rockell and Brinnel – hardness testing

Learning outcomes	Teaching content
The Learner will:	**Learners must be taught:**
4. Understand how non-destructive testing methods are used for quality assurance in a manufacturing environment	4.1 which type of material or component each non-destructive testing method is suitable for 4.2 the advantages and limitations of each non-destructive testing method 4.3 non-destructive testing methods, i.e. • visual • dye penetration testing – detect surface breaking flaws in non-ferromagnetic materials • magnetic particle inspection – particle crack detection of surface and near-surface discontinuities in magnetic material, mainly ferric steel and iron • ultrasonic flaw detection – detect internal and surface (particularly distant surface) defects in cound conducting materials • radiography X-ray – internal defects in ferrous and non-ferrous metals and other materials • eddy current and electro-magnetic testing – detection of surface or sub-surface flaws, conductivity measurement and coating thickness measurement
5. Understand automatic inspection and testing techniques which are used in manufacturing	5.1 automatic inspection techniques, i.e. • robotics • computer vision • optical inspection • Co-ordinate Measuring Machine (CMM) - device for measuring the physical geometrical characteristics of an object 5.2 how automatic inspection techniques are used in quality assurance in manufacturing 5.3 the advantages and limitations of automatic inspection techniques 5.4 types of automatic testing techniques used in manufacturing (e.g. Automated Test Equipment (ATE) - computer-operated machine used to test devices for performance and capabilities)
	5.5 how automatic testing techniques are used in manufacturing, i.e. • scope of use • speed • limitations and advantages (e.g. scales of operations, costs of implementing, impact on production line) • what is being detected • protocols and systems • setting up

GRADING CRITERIA

LO	Pass	Merit	Distinction
	The assessment criteria are the Pass requirements for this unit.	To achieve a Merit the evidence must show that, in addition to the Pass criteria, the candidate is able to:	To achieve a Distinction the evidence must show that, in addition to the pass and merit criteria, the candidate is able to:
1. Understand how inspection and testing methods and processes improve quality control	P1 Explain how PPAP and FOLO inspection and testing methods are used to minimise quality issues.	M1 Assess the advantages or limitations of different inspection and testing methods for the production of a product.	D1 Create a testing schedule for the production of a product.
	P2 Explain how Statistical Process Control (SPC) is used for quality control in manufacturing.	M2 Use data to produce an SPC moving range chart.	
2. Understand how defects can occur in manufacturing materials, processes and components	P3 Explain different types of defects which can occur in materials and their effects **Synoptic link to Unit 2 Science for Engineering*	M3 Explain how defects in materials can cause manufacturing process defects.	D2 Analyse causes and effects of in-service defects in different manufactured components and their relationship with material and manufacturing process defects.
	P4 Explain different types of defects which can occur in manufacturing processes and their effects.		

LO	Pass	Merit	Distinction
3. Understand how destructive testing methods are used for quality assurance in manufacturing	P5 Explain which types of material or components are suitable for destructive testing **Synoptic link to Unit 2 Science for Engineering*	M4 Analyse the advantages and limitations of destructive and non-destructive testing methods for quality assurance in manufacturing.	
	P6 Explain how destructive testing methods are used for quality assurance in manufacturing.		
4. Understand how non-destructive testing methods are used for quality assurance in a manufacturing environment	P7 Explain which types of material or components are suitable for non-destructive testing **Synoptic link to Unit 2 Science for Engineering*		
	P8 Explain how non-destructive testing methods are used for quality assurance in manufacturing.		
5. Understand automatic inspection and testing techniques which are used in manufacturing	P9 Describe different automatic inspection and testing techniques which are used in manufacturing and how they are used.	M5 Analyse the advantages and limitations of different automatic inspection and testing techniques which are used in manufacturing.	

*SYNOPTIC ASSESSMENT AND LINKS BETWEEN UNITS

When learners are taking an assessment task, or series of tasks, for this unit they will have opportunities to draw on relevant, appropriate knowledge, understanding and skills that they will have developed through other units. We've identified those opportunities in the grading criteria. Learners should be encouraged to consider for themselves which skills/knowledge/understanding are most relevant to apply where we have placed an asterisk.

ASSESSMENT GUIDANCE

LO1: Understand how inspection and testing methods and processes improve quality control
Learners should explain and assess inspection and testing methods and be able to create a testing schedule. M2 requires the use of data to produce an SPC moving range chart. Teachers may need to supply learners with suitable information and data.

LO2: Understand how defects can occur in manufacturing materials, processes and components
Learners should be able to explain different types of defects and how defects in materials cause manufacturing process defects. P4 provides an opportunity to apply knowledge of material properties learnt in Unit 2. Teachers could use suitable examples from which learners could conduct their investigations.

LO3: Understand how destructive testing methods are used for quality assurance in manufacturing
Learners should explain destructive testing methods. P5 provides an opportunity to draw upon knowledge learnt in Unit 2. It is not required to perform practical destructive testing for this LO, although this could be done if access to suitable resources is available.

LO4: Understand how non-destructive testing methods are used for quality assurance in a manufacturing environment
Learners should explain non-destructive testing methods. P7 provides an opportunity to draw upon knowledge learnt in Unit 2. It is not required to perform practical non-destructive testing for this LO, although this could be done if access to suitable resources is available.

LO5: Understand automatic inspection and testing techniques which are used in manufacturing
Learners should describe and analyse automatic inspection and testing techniques used in manufacturing. Teachers might use case studies of suitable examples to demonstrate automatic inspection and testing, or might be able to arrange an industrial visit to see this in operation.

Feedback to learners: you can discuss work-in-progress towards summative assessment with learners to make sure it's being done in a planned and timely manner. It also provides an opportunity for you to check the authenticity of the work. You must intervene if you feel there's a health and safety risk.

Learners should use their own words when producing evidence of their knowledge and understanding. When learners use their own words it reduces the possibility of learners' work being identified as plagiarised. If a learner does use someone else's words and ideas in their work, they must acknowledge it, and this is done through referencing. Just quoting and referencing someone else's work will not show that the learner knows or understands it. It has to be clear in the work how the learner is using the material they have referenced to inform their thoughts, ideas or conclusions.

For more information about internal assessment, including feedback, authentication and plagiarism, see the centre handbook. Information about how to reference is in the OCR Guide to Referencing available on our website: http://www.ocr.org.uk/i-want-to/skills-guides/.

MEANINGFUL EMPLOYER INVOLVEMENT - a requirement for the Foundation Diploma, Diploma and Extended Diploma (tech level) qualifications

The 'Diploma' qualifications have been designed to be recognised as Tech Levels in performance tables in England. It is a requirement of these qualifications for centres to secure for every learner employer involvement through delivery and/or assessment of these qualifications.

The minimum amount of employer involvement must relate to at least one or more of the elements of the mandatory content (this unit is a mandatory unit in the Manufacturing pathway).

Eligible activities and suggestions/ideas that may help you in securing meaningful employer involvement for this unit are given in the table below.

Please refer to the *Qualification Handbook* for further information including a list of activities that are not considered to meet this requirement.

Meaningful employer engagement	Suggestion/ideas for centres when delivering this unit
1. Learners undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification.	Placements with engineering firms working with quality/ inspection department researching inspection and testing as part of component manufacture and/or adherence to assembly standards.
2. Learners undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s).	Task set to measure and inspect of components using industry standard equipment, to determine if the product and production method is fit for purpose. (could involve PPAP and SPC run charts)
3. Learners 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.	Lecture from practicing Quality engineers involved in product inspection, development and destructive or non-destructive testing. Content to include examples of methodology, calculations and working documentation within professional commercial engineering practice.
4. Industry practitioners operating as 'expert witnesses' that contribute to the assessment of a learner'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.	Review from practicing Quality engineers, assessing the quality of learners' inspection reports based on the manufacture and testing of engineered components or products

To find out more
ocr.org.uk/engineering
or call our Customer Contact Centre on **02476 851509**

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

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