2016 Suite

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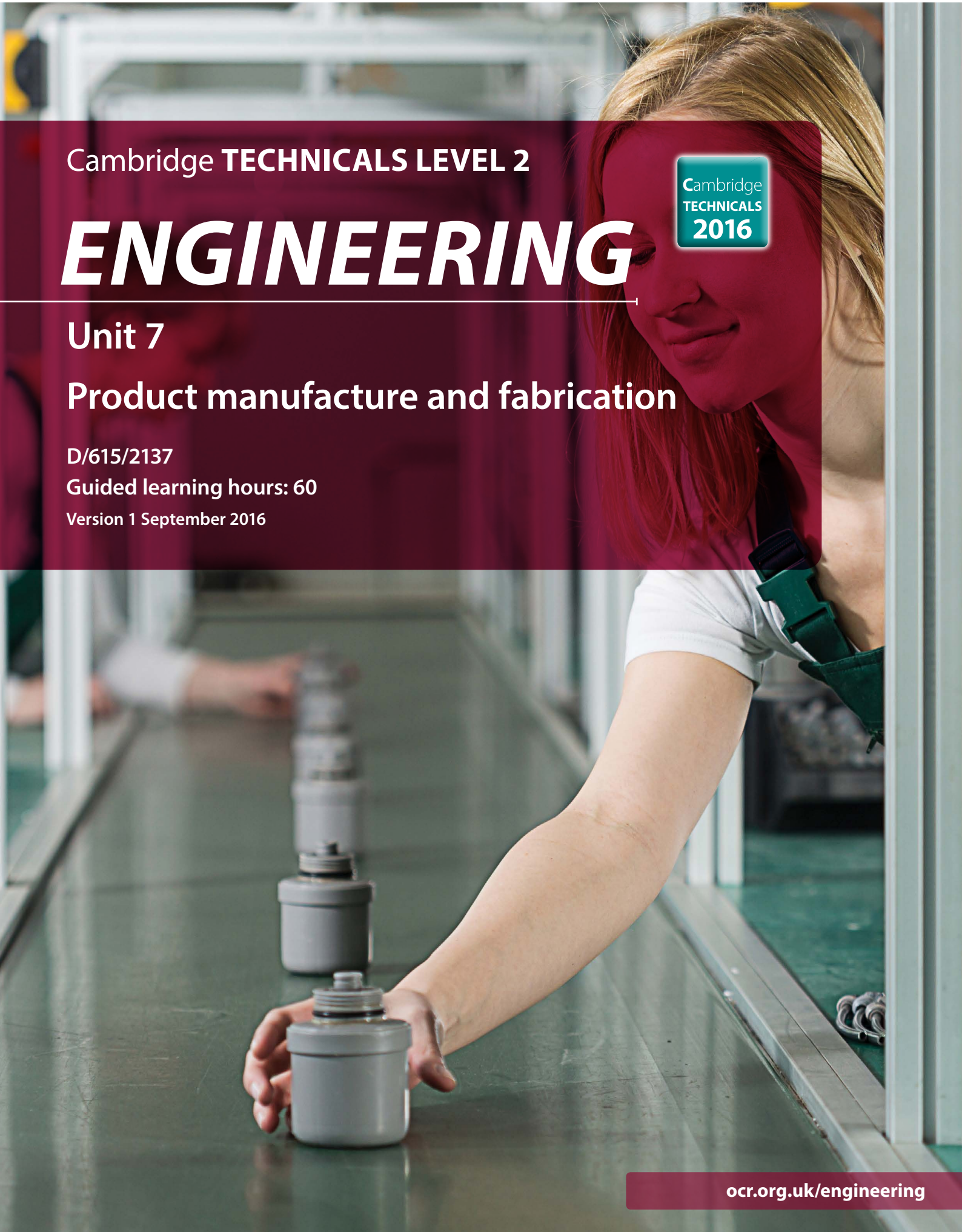

Cambridge **TECHNICALS LEVEL 2**

Cambridge TECHNICALS 2016

ENGINEERING

Unit 7

Product manufacture and fabrication

D/615/2137

Guided learning hours: 60

Version 1 September 2016

ocr.org.uk/engineering

LEVEL 2

UNIT 7: PRODUCT MANUFACTURE AND FABRICATION D/615/2137

Guided learning hours: 60

Essential resources required for this unit: Hand tools, soldering, welding, adhesives and assembly consumables

This unit is internally assessed and externally moderated by OCR.

Unit aim

Once engineers have designed a product, the production engineer devises exactly how it is going to be made, what processes and machines are going to be used and how it can be made as efficiently and as safely as possible. Some products are only made as one-offs whilst others are made in their millions. This unit will explore engineering production systems.

Learners will develop knowledge and understanding of how a product manufacturing process is devised and implemented and undertake practical activities to develop their understanding of:

- Health and Safety practice
- assembly techniques
- lean manufacture
- quality systems
- planning manufacturing production
- scale of production
- how production machines work

TEACHING CONTENT

The unit content describes what has to be taught to ensure that learners are able to access the highest grade.

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 to their work though these do not need to be the same ones specified in the unit content.

Learning Outcome The Learner will:		Teaching Content The Learner must be taught:
1. Be able to prepare and plan for product assembly and manufacture	1.1	factors that affect product assembly and manufacture i.e. • scale of production i.e. o one off o batch o continuous flow • unit cost of production (e.g. quantity versus price) • tool and equipment availability/ capability (e.g. operation or process limitations) • human resources (e.g. team roles and responsibilities, availability, skills, cost) • physical resources (e.g. materials, availability, cost) • procedures (e.g. standard operating, sequence of operation, quality) • customer requirements (e.g. non-standards/ a-typical, time) • quality procedures (e.g. control, standards, Total Quality Management) • lean manufacture principles i.e. o continuous improvement (e.g. constant, necessary change to improve production time, cost and efficiency) o waste reduction (e.g. production/ processing, motion, defects, waiting, transportation) o Just in Time (JIT) (e.g. what is required, when it is required and in the quantity required)
	1.2	to produce a product assembly and manufacturing plan for a one off component to include i.e. • preproduction documents (e.g. drawings, specifications, working instructions,) • bill of materials (e.g. list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, parts and the quantities of each needed to manufacture an end product) • operations and processes (e.g. tools and equipment, safety, quality checks, finishing packaging, storage and dispatch)

Learning Outcome The Learner will:		Teaching Content The Learner must be taught:
	1.2	to modify a product assembly and manufacturing plan to use for batch and continuous flow production i.e. • impact of quantities of production i.e. o process o sequence of operation o timing o quality control o safe working processes
2. Be able to follow efficient and safe working procedures for product assembly and manufacture	2.1	to perform efficient working procedures for product assembly and manufacture i.e. • cost efficiencies of i.e. o energy (e.g. turning off lights when leaving an empty room) o resources (e.g. accurate tessellation when cutting materials) o time (e.g. time dependent and time sensitive procedures) o process (e.g. planning to avoid wasted time/ resource/ energy) • environmental efficiencies (e.g. sourcing of sustainable materials, recycling, reduction of waste/ pollution, energy consumption)
	2.2	to perform safe working procedures for product assembly and manufacture i.e. • use of safety features on production machinery (e.g. emergency stop, guards, interlocks) • use of Personal Protective Equipment (PPE) • COSHH • safe storage (e.g. hazardous materials, heavy/ bulky material, expensive resources) • correct manual handling (e.g. transporting heavy items) • disposal of waste materials • Local Exhaust Ventilation (LEV) procedures • noise reduction and control procedures
3. Be able to produce an engineering product using product assembly and manufacturing techniques	3.1	to use mechanical fastenings for product assembly and manufacture i.e. • threaded fasteners (e.g. nuts and bolts, studs, self-tapping screws, lock nuts) • non-threaded fasteners (e.g. locking wire, rivets, circlips, spring and snap-in fasteners, keys and key ways, seaming and crimping)
	3.2	to use adhesives for product assembly and manufacture i.e. • pre-assembly (e.g. preparation of surfaces, curing) • assembly (e.g. jigs, fixtures, temperature control, pressure, special atmospheric conditions) • safety requirements (e.g. fumes, accidental spillage)
	3.3	to use hot jointing techniques for product assembly and manufacture (e.g. spot welding, continuous seam welding, brazing, soldering)

Learning Outcome The Learner will:		Teaching Content The Learner must be taught:
4. Be able to apply quality control checks to product assembly and manufacture	4.1	to apply quality standards to check for accuracy and tolerance i.e. • quality control (e.g. application of tolerance, sampling, comparison, corrective actions) • quality assurance (e.g. critical control points, no faults forward, visual checks, measurements, comparators)
	4.2	to select and use techniques for evaluating product quality control i.e. • comparison of variables (e.g. length, height, diameter, depth, resistance, temperature) • appearance (e.g. surface finish, defects, blemishes, damage) • recognised quality standards (e.g. BSI, ISO, CE, food standards) • fitness for purpose (e.g. sufficiently robustly constructed, safe to handle or use)
	4.3	to apply Statistical Process Control (SPC) analysis in product assembly and manufacture i.e. • measurement of data (e.g. data trends, tolerances) • statistical representation (e.g. mean, mode, median)

GRADING CRITERIA

Learning Outcome	Pass	Merit	Distinction
The learner will:	The assessment criteria which 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. Be able to prepare and plan for product assembly and manufacture	P1 Identify factors that affect product assembly for single, batch and continuous flow production	M1 Explain how the principles of lean manufacture in product assembly and manufacture can impact on: • scale of production • unit cost • tools and equipment • human/ physical resources • operating processes and procedures • quality procedures	
	P2 Produce a product assembly and manufacturing plan for a one off component		
	P3 Modify a product assembly and manufacturing plan to use for batch and continuous flow production		
2. Be able to follow efficient and safe working procedures for product assembly and manufacture	P4 Perform cost effective, environmentally efficient and safe working procedures for product assembly and manufacture		
3. Be able to produce an engineering product using product assembly and manufacturing techniques	P5 Produce an engineering product using mechanical fastenings for product assembly and manufacture		
	P6 Produce an engineering product using adhesive(s) for product assembly and manufacture		

Learning Outcome	Pass	Merit	Distinction
	P7 Produce an engineering product using hot joining technique(s) for product assembly and manufacture		
4. Be able to apply quality control checks to product assembly and manufacture	P8 Perform checks for accuracy and tolerance using quality standards for product assembly and manufacture	M2 Explain the importance of quality checks for product assembly and manufacture, with reference to: • quality control • quality assurance	D1 Evaluate the quality of a product using Statistical Process Control (SPC) analysis to include: • comparison of variables • appearance • recognised quality standard(s) • fitness for purpose
	P9 Select and use techniques for evaluating quality control in product assembly and manufacture		
	P10 Use Statistical Process Control (SPC) analysis to check quality standards in product assembly and manufacture		

ASSESSMENT GUIDANCE

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/.

P1
Learners could produce a report or presentation (including detailed speaker notes) to identify factors that affect product assembly for single, batch and continuous flow production.

P2 – P3
For P2 evidence should be in the form of a product assembly and manufacturing plan for a one off component. For P3 learners should produce a modified plan that would be suitable for use when making the product in batch and continuous flow production.

M1
Learners could produce a report or presentation (including detailed speaker notes) to explain how the principles of lean manufacture in product assembly and manufacture can impact on;

- scale of production
- unit cost
- tools and equipment
- human/ physical resources
- operating processes and procedures
- quality procedures

P4
This could form part of a learners plan for product assembly and manufacture. Learners must demonstrate how they have carried out the cost effective, environmentally efficient and safe working procedures. Evidence could be in the form of a plan to support their practical activity and could include photographs or video footage with accompanying annotations, supported by witness statements.

P5 - P7
Learners must demonstrate how they have used product assembly and manufacturing techniques (mechanical fastenings, adhesives and hot joining). The product assembly and manufacture for P5, 6 and 7 does not necessarily need to comprise of a single product assembly. Learners can demonstrate each technique separately to meet each pass criteria or together as part of an engineered product assembly. Evidence could be in the form of photographs or video footage with accompanying annotations, which should be supported by witness statements.

P8- P10
This could form part of a learners plan for product assembly and manufacture. Learners must demonstrate how they have carried out checks for accuracy and tolerance using quality standards, how they have selected and used techniques for evaluating quality control and used Statistical Process Control (SPC) analysis to check quality standards. Evidence for P8 should be in the form of photographs or video footage of learners performing checks for accuracy and tolerance with accompanying annotations, which should be supported by witness statements. Evidence for P9 and P10 could be in the form of a presentation that contains charts, graphs, data sheets, spread sheets and statistical analysis which should be accompanied by detailed speaker notes.

M2
Learners could produce a report or presentation (including detailed speaker notes) to explain the importance of quality checks for product assembly and manufacture. The explanation should include references to;

- quality control
- quality assurance

D1
Learners must use Statistical Process Control (SPC) analysis to evaluate against the given criteria. The data can be collected but must be sufficient to satisfy the given criteria of, comparison of variables; appearance; recognised quality standards; and fitness for purpose. Learners can use data gathered from practical activities or supplied by the tutor. The given criteria can be satisfied by more than one set of statistical data.

SYNOPTIC ASSESSMENT AND LINKS BETWEEN UNITS

It will be possible for learners to make connections between other units over and above the unit containing the key tasks for synoptic assessment, please see section 6 of the centre handbook for more detail.

Synoptic assessment grid

This unit and specific LO	Related unit	Related LO
Unit 7 LO1 Be able to prepare and plan for product assembly and manufacture	Unit 1	LO1 1.1 LO2 2.1, 2.2 LO3 3.1, 3.2
	Unit 2	LO1.1 LO2 2.1, 2.2 LO3 3.1
	Unit 3	LO1 1.1, 1.2, 1.3 LO2 2.1 LO4 4.1 LO5 5.1, 5.2 LO6 6.1, 6.2
	Unit 4	LO1 1.1, 1.2, 1.3
	Unit 5	LO2 2.1
	Unit 8	LO1 1.3 LO2 2.2 LO3 3.1, 3.4
Unit 7 LO2 Be able to follow efficient and safe working procedures for product assembly and manufacture	Unit 1	LO2 2.1, 2.2 LO3 3.1, 3.2
	Unit 2	LO3 3.1
	Unit 3	LO1 1.1, 1.2, 1.3 LO2 2.1 LO4 4.1 LO5 5.1, 5.2 LO6 6.1, 6.2
	Unit 4	LO1 1.1, 1.2, 1.3
	Unit 5	LO2 2.1
	Unit 8	LO1 1.3 LO2 2.2 LO3 3.1, 3.4
Unit 7 LO3 Be able to produce an engineering product using product assembly and manufacturing techniques	Unit 1	LO2 2.1, 2.2 LO3 3.1, 3.2
	Unit 2	LO2 2.1, 2.2 LO3 3.1
	Unit 3	LO1 1.1, 1.2, 1.3 LO2 2.1 LO4 4.1 LO5 5.1, 5.2 LO6 6.1, 6.2
	Unit 4	LO1 1.1, 1.2, 1.3
	Unit 5	LO2 2.1
	Unit 8	LO1 1.3 LO2 2.2 LO3 3.1, 3.4

This unit and specific LO	Related unit	Related LO
Unit 7 LO4 Be able to apply quality control checks to product assembly and manufacture	Unit 1	LO1 1.1 LO2 2.1, 2.2
	Unit 3	LO6 6.1, 6.2
	Unit 4	LO1 1.1, 1.2, 1.3
	Unit 5	LO4 4.1
	Unit 8	LO3 3.4, 3.5

MEANINGFUL EMPLOYER INVOLVEMENT - A REQUIREMENT FOR TECHNICAL CERTIFICATE QUALIFICATIONS

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

The minimum amount of employer involvement must relate to at least one or more of the elements of the mandatory content. This unit is mandatory in the Production Engineering 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 involvement – eligible activities	Suggestion/ideas for centres when delivering this unit
1. Students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification.	Learners undertake work placements in engineering manufacturing businesses. Learners should get the opportunity to gain practical exposure to how manufacturing takes place. Employers host in-centre or industrially placed master classes showcasing use of tools, techniques and practices, supported with examples of components or products Manufactured using different product assembly and manufacturing techniques.
2. Students undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s).	Employers give centres engineering drawings of components that learners have to produce using product assembly and manufacturing techniques.
3. 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.	Ensure employer input through master classes where employers showcase best practice methodologies in the use of CAM tools, software and machinery.

You can find further information on employer involvement in the delivery of qualifications in the following documents:

- Employer involvement in the delivery and assessment of vocational qualifications
- DfE work experience guidance

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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