



Cambridge TECHNICALS 2016

Cambridge TECHNICALS LEVEL 3

# ENGINEERING

Unit 13

### **Mechanical operations**

J/506/7279 Guided learning hours: 60 VERSION 4 -June 2017 black line indicates updated content

#### LEVEL 3

#### **UNIT 13: MECHANICAL OPERATIONS**

#### J/506/7279

#### Guided learning hours: 60

**Essential resources required for this unit:** marking out tools (see assessment guidance), hand tools (see assessment guidance), suitable PPE, centre lathe and tooling, drilling machine and tooling, milling machine and tooling, consumable resources (e.g. metals, plastics etc), measuring equipment (see assessment guidance)

#### This unit is internally assessed and externally moderated by OCR.

#### UNIT AIM

Production and manufacturing businesses depend on a team that can actually plan production, carry out production with the appropriate equipment, and quality assure what they have physically produced.

The aim of this unit is for learners to develop the ability to plan for production, and to manufacture components safely. Learners will develop their knowledge of manufacturing techniques to include marking out, use of hand tools and the operation of manually controlled machines such as lathes and milling and drilling machines. They will produce mechanical components and will be able to quality assure their own work as being fit for purpose.

#### **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:	
<ol> <li>Be able to plan for production in mechanical engineering</li> </ol>	<ul> <li>1.1 how to apply safe working procedures in a mechanical operations environment i.e.</li> <li>observance of safety notices and codes of conduct</li> <li>how to produce and use safe work method statements for performing mechanical operations</li> <li>how to carry out risk assessments for mechanical operations</li> <li>the appropriate use and storage of Personal Protective Equipment (PPE)</li> <li>disposal of waste</li> <li>1.2 how to correctly interpret engineering drawings for manufacture using first and third angle orthographic projections e.g.</li> <li>types of line, dimensions, annotations</li> </ul>	
2. Be able to use bench processes, tools and equipment to produce quality components	<ul> <li>2.1 how to use bench tools:</li> <li>use of marking tools and equipment i.e.</li> <li>surface gauge and height gauge</li> <li>surface plate</li> <li>vee blocks</li> <li>angle plates</li> <li>scribe</li> <li>centre punch and dot punch</li> <li>odd leg calipers</li> <li>dividers</li> <li>engineer's square</li> <li>combination set</li> <li>engineer's blue</li> </ul>	

Learning outcomes	ing outcomes Teaching content	
The Learner will:	Learners must be taught:	
	<ul> <li>use of hacksaw and junior hacksaw and the importance of tooth size</li> <li>use of flat, hand, warding, half round, round, square and three square files of grades from rough to smooth</li> <li>filing techniques i.e.: cross-filing and draw filing</li> <li>use of vice clamps and tool makers clamps</li> <li>use of hand taps and dies</li> <li>use of tapping and clearance drills</li> </ul>	
	<ul> <li>2.2 how to use bench processes:</li> <li>how to write a Standard Operating Procedure for assembly</li> <li>how and where to use a range of temporary fastenings i.e.</li> <li>nuts</li> <li>bolts</li> <li>self-tapping screws</li> <li>machine screws</li> <li>correct assembly procedures i.e.</li> <li>torque settings</li> <li>sequence of tightening</li> <li>thread locking</li> </ul>	
3. Be able to use the centre lathe to produce quality components	<ul> <li>3.1 how to perform manually controlled machining operations on the centre lathe, i.e.</li> <li>speeds and feeds for common metals</li> <li>turning operations on the lathe, including <ul> <li>facing</li> <li>plain/parallel turning</li> <li>grooving</li> <li>taper turning</li> <li>knurling</li> <li>external screw cutting</li> <li>drilling and boring</li> </ul> </li> <li>use of three and four jaw chucks</li> <li>turning between centres</li> </ul>	
4. Be able to use drilling and milling machines to produce quality components	<ul> <li>4.1 how to perform manually controlled machining operations on milling and drilling machines, i.e.</li> <li>speeds and feeds for common metals</li> <li>milling in vertical or horizontal milling machines</li> <li>correct work holding using clamps and vices</li> <li>use of dividing head and rotary table</li> <li>milling at angles to the bed</li> <li>use of pitch circle diameter</li> <li>use of drilling machines to drill, ream, counter bore and spot face</li> </ul>	

Learning outcomes		Teaching content Learners must be taught:	
5.	Be able to quality assure components	<ul> <li>5.1 how to use measuring equipment i.e.</li> <li>rule</li> <li>vernier calipers</li> <li>digital calipers</li> <li>micrometer</li> <li>combination set and engineer's square</li> </ul> 5.2 how to apply planned quality control checks i.e. <ul> <li>checking against drawings</li> <li>identifying important dimensions</li> <li>tolerances</li> <li>concentricity</li> <li>surface finish</li> <li>visual inspection</li> <li>random sampling</li> </ul>	

#### **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.	Be able to plan for production in mechanical engineering	P1: Safely prepare for working procedures in mechanical operations.		
		P2: Interpret engineering drawings for manufacture.		
		P3: Create a production plan.	M1: Create a safe work method statement.	
2.	Be able to use bench processes, tools and equipment to produce quality components	P4: Use marking tools and equipment safely and effectively.		
		P5: Use a range of hand tools safely and effectively.		
		P6: Produce threads using taps and dies.		
		P7: Produce a Standard Operating Procedure for assembly.		
		P8: Use a range of temporary fastenings.		

LO		Pass	Merit	Distinction
3.	Be able to use the centre lathe to produce quality components	P9: Use the centre lathe safely.		D1: Cut an external screw thread or internal bore so that the components have a good running fit.
		P10: Manufacture turned parts using face, parallel and taper turn operations.	M2: Manufacture turned parts within a specified tolerance.	
		P11: Calculate correct feed and speed for work piece. * synoptic link to Unit 1 Mathematics for Engineering	M3: Cut grooves, knurls and drills using the tailstock.	
4.	Be able to use drilling and milling machines to produce quality components	P12: Use the milling machine safely.	M4: Manufacture milled and drilled parts within a specified tolerance.	D2: Use a dividing head effectively and accurately.
		P13: Manufacture milled parts using correct feed and speed for cutter.	M5: Use pitch circles accurately.	
		P14: Use the bench/pillar drill correctly and safely.		
5.	Be able to quality assure components	P15: Make effective use of appropriate measuring equipment.	M6: Adapt working practice in light of quality control results.	
		P16: Apply quality control checks in the manufacturing process.		

#### **\*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: Be able to plan for production in mechanical engineering

Learners should produce production plans and safe work method statements with due attention to health and safety. Teachers may wish to supply learners with exemplar formats of these to use, such as those available from the Health and Safety Executive (HSE) website.

LO2: Be able to use bench processes, tools and equipment to produce quality components

Learners should be able to safely and competently use a range of marking out and hand tools. Teachers might provide learners with activities whereby they can demonstrate the application of a range of tools and techniques. Learners might keep a record (e.g. log book) including photographic evidence of activities undertaken.

LO3: Be able to use the centre lathe to produce quality components

Learners should be able to safely and competently use a centre lathe. Teachers might provide learners with a range of activities whereby they can demonstrate the application of a range of turning techniques. Learners might keep a record (e.g. log book) including photographic evidence of activities undertaken.

LO4: Be able to use drilling and milling machines to produce quality components

Learners should be able to safely and competently use a drilling and a milling. Teachers might provide learners with a range of activities whereby they can demonstrate the application of a range of drilling and milling techniques. Learners might keep a record (e.g. log book) including photographic evidence of activities undertaken.

#### LO5: Be able to quality assure components

Learners should be able to use a range of measuring instruments and quality assurance techniques to quality assure components. Components should ideally be those produced by the learner, but could be ones supplied by the teacher. Learners should provide evidence of quality assurance checks being performed. For M4 learners should suggest adaptations to working practice based on the outcome and results of quality control results.

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: <u>http://www.ocr.org.uk/i-want-to/skills-guides/</u>.

## **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.

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.

Me	eaningful 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 production/inspection departments, researching component manufacture and/or the assembly standards used.
2.	Learners undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s).	Task set on the measurement and inspection of components using industry standard equipment, to determine if a planned production method meets the required industrial standard.
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.	Master class from practicing manufacturing/process engineers involved in product manufacture and inspection. 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.	Formal input from practicing manufacturing/process engineers relating to the clarity of diagrams and correct identification of manufacturing principles and or inspection techniques by learners during project work and in documentation.

#### 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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