ENGINEERING MANUFACTURE





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KS4 PERFORMANCE TABLES

Specification

Cambridge OCR Level 1/Level 2

Cambridge National in

Engineering Manufacture

J823

Version 7 (First teaching September 2022)

ocr.org.uk/cambridgenationals

Cambridge Nationals

CAMBRIDGE OCR

About our new name

As of September 2025, our name is Cambridge OCR.

Students who sat an exam **in summer 2025** will receive a Cambridge OCR branded exam certificate (our new brand), which will be the same for all future exam series.

You'll continue to see the OCR or Oxford Cambridge and RSA Examinations name while we work to update our material to our new name, Cambridge OCR. This will take some time, and you can still access all up-to-date qualification resources and materials via Teach Cambridge.

Important: We'll keep the OCR/Oxford Cambridge and RSA name on existing teaching resources while the content of these remains applicable to the specification being taught. **New and refreshed** resources will be produced using the Cambridge OCR name/logo.

Are you using the latest version of this specification?

The latest version of our specifications will always be on our website and may differ from printed versions. We will inform centres about changes to specifications.

Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. We want you and your students to enjoy and get the best out of our qualifications and resources, but to do that we need your honest opinions to tell us whether we're on the right track or not.

You can email your thoughts to support@ocr.org.uk or visit our feedback page to learn more about how you can help us improve our qualifications.


Designing and testing in collaboration with teachers and students


Helping young people develop an ethical view of the world


Equality, diversity, inclusion and belonging (EDIB) are part of everything we do

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Specification updates

Key changes have been listed below:

Section	Change	Version and date issued
Qualification overview Section 6.1.1: Centre and teacher/ assessor responsibilities Section 6.2: Requirements and guidance for delivering and marking the OCR-set assignments Section 6.3: Feedback Section 6.4.4: Reattempting work before submitting marks to OCR	Updated to clarify information relating to NEA resubmissions.	Version 2 (May 2022)
Section 6.5: Moderating NEA units	Updated information on how to submit moderated units.	
Section 6.6: Resubmitting moderated work to OCR to improve the grade Section 6.7: Recording feedback and decisions	New sections added to clarify information relating to NEA resubmissions.	
Section 7: Administration	Updated information to clarify administrative arrangements.	
Appendix A: Guidance for the production of electronic evidence	Updated information related to 'Submit for Assessment'.	
All	Weblinks updated.	
Section 2.1: Qualification overview	Updated to clarify information relating to Availability and Assessment method/model.	Version 3 (August 2023)
Section 3.2: Language	Updated to clarify this qualification is available in English only and all candidate work must be in English.	
Section 3.3: Availability	New section added to clarify qualification is not available in Wales or Northern Ireland.	
Section 6.1.1 Centre and teacher/ assessor responsibilities	Updated to clarify information relating to the availability of sample assessment material for practice purposes.	
Section 6.1.1 Centre and teacher/ assessor responsibilities Section 6.2 Requirements and guidance for delivering and marking the OCR set assignments. Section 6.2.1 Ways to authenticate work Section 6.2.2 Plagiarism	Updated to include information relating to AI Use in Assessments.	
Section 6.2 Requirements and guidance for delivering and marking the OCR set assignments	Updated to clarify information relating to availability of live assignments and making entries.	

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Section	Change	Version and date issued
Section 7.5.2 Making final unit entries	Updated to clarify information about making unit entries.	
Appendix A	Updated standard file formats table.	
Section 2.1 Qualification at a glance	Updated information on terminal assessment and exam resits	Version 4 May 2024
Section 4.1.1 Terminal Assessment Rule	New section added to provide information on the terminal assessment rule	
Section 4.3 Unit R015: Manufacturing a one-off product	Unit R015 - Topic Area 1: Planning the production of a one-off product exemplification updated	
	Unit R015 - Topic Areas 2.1 and 2.2: Measuring and marking out marking criteria updated	
	Unit R015 - Topic Area 3.1: Manually controlled machining processes marking criteria updated	
	Unit R015 - Topic Area 3.2 and 3.3: Tools and equipment and joining techniques marking criteria updated	
	Assessment guidance - Task 3 assessment guidance updated	
	Assessment guidance - Task 4 assessment guidance updated	
Section 4.4 Unit R016: Manufacturing in quantity	Unit R016 - Topic Area 1: Preparing for manufacture exemplification updated	
	Unit R016 - Topic Area 2: Develop programmes to operate CNC equipment exemplification updated	
	Unit R016 - Topic Area 3: Safely use processes and equipment to make products in quantity teaching content and exemplification updated	
	Unit R016 - Topic Area 1.1: Manufacture and use templates marking criteria updated	
	Unit R016 - Topic Areas 2.1 and 2.2: Use CAD software and program CNC machine operations marking criteria updated	
	Unit R016 - Topic Areas 3.1 and 3.2: Setting up and operating CNC equipment marking criteria updated	
	Unit R016 - Topic Area 3.3: Apply quality control methods marking criteria updated	
	Assessment guidance - Task 1 assessment guidance updated	
	Assessment guidance - Task 3 assessment guidance updated	
	Assessment guidance - Task 4 assessment guidance updated	
Section 5.1 Overview of the assessment	Updated to clarify the terminal rule	
Section 6.3.7 Presentation of the final piece of work	Updated information on submission of work for moderation	

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Section	Change	Version and date issued
Section 7.2 Collecting evidence of student performance to ensure resilience in the qualifications system	New section added to provide information on collecting evidence of student performance to ensure resilience in the qualifications system	
Section 7.3 Entry rules, including Terminal Assessment	Updated to clarify information relating to entry rules and terminal assessment	
Section 7.6 Making final entries	Updated to clarify use of component codes	
All	Updated information to ensure compliance with new JCQ requirements and guidance.	Version 5 (September 2025)
All	References to 'Command words' have been replaced with 'Command and/or descriptor words', to cover both types of assessments. These are now called Descriptor Words for NEA units.	
Section 2	Included the lifespan for each set assignment and that live dates are shown on the front cover.	
Section 6	Improved clarity and guidance on: • use of the set assignment. • providing feedback to students. • resubmitting moderated work. Additional information provided to support the delivering and assessing of NEA units in line with JCQ instructions and guidance.	
Covers and all page footers	Updated to reflect the new Cambridge OCR brand. Inside cover includes statement: 'About our new name'.	
Throughout	Hyperlinks refreshed The following forms are now only available on Teach Cambridge: unit recording sheets (URS) and set assignment feedback form	Version 6 (June 2026)
Section 5.4 Grading and awarding grades	Updated to clarify on results day a marks calculator will be published for the specific series	
Section 6.1.1 Centre and teacher/ assessor responsibilities	Updated name of online training module and information about centre approval	
Section 6.2.2 Plagiarism (including AI misuse)	Updated to include more information relating to AI misuse in assessments and required teaching for referencing or acknowledging material copied from the internet or other sources	
Section 6.3 Feedback	Add new section: *Informing students of their marks*	
Section 6.6 Resubmitting moderated work to us to improve the grade	Updated to clarify information relating to using work from a previous year's assignment	
Section 7.9 Post-results services	Updated access to scripts, which is a free service for exams officers to download copies of students' completed question papers	
Section 6.3.3 Candidate and teacher authentication	Updated title to 'Candidate and teacher authentication' to reflect JCQ's recent merge of centre authentication and candidate authentication statement forms into one form.	Version 7 (October 2026)

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1 Why choose OCR?

Choose OCR and you've got the reassurance that you're working with one of the UK's leading exam boards. We have developed our specifications in consultation with teachers, employers and subject experts to provide students with a qualification that's relevant to them and meets their needs.

We're part of Cambridge University Press & Assessment. We help millions of people worldwide unlock their potential. Our qualifications, assessments, academic publications and original research spread knowledge, spark curiosity and aid understanding around the world.

We work with teachers, employers, and universities to create qualifications that support the needs of all students and help them prepare for their future. We offer A Levels, GCSEs, vocational qualifications, and other academic options to schools, colleges, workplaces, and other organisations.

1.1 Our specifications

We believe in developing specifications that help you bring the subject to life and inspire your students to achieve more. We've created teacher-friendly specifications based on extensive research and engagement with the teaching community. They're designed to be straightforward and accessible so that you can tailor the delivery of the course to suit your needs.

1.2 Our support

We have a range of support services to help you at every stage, from preparation to delivery.

- A wide range of high-quality creative resources including resources created by leading organisations within the industry.
- Textbooks and teaching and learning resources from leading publishers. For more information about all the published support for the Cambridge Nationals that has been endorsed by OCR please go to the Cambridge Nationals page on our website.
- Professional development for teachers to fulfil a range of needs. To join our training (either face-to-face or online) or to search for training materials, please go to the Professional Development page on our website.
- Active Results is our free results analysis service to help you review the performance of individual students or whole schools.
- ExamBuilder is our free question-building platform that helps you to build your own tests using past OCR exam questions.
- OCR subject advisors provide information and support to centres including specification and non examined assessment advice, updates on resources developments and a range of training opportunities. They work with subject communities through a range of networks to share ideas and expertise to support teachers.

Further help and support

Whether you are new to OCR or already teaching with us, you can find useful information, help and support on our website. Or get in touch:

support@ocr.org.uk

@ocrexams

01223 553998

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1.3 Aims and learning outcomes

Our Cambridge National in Engineering Manufacture will encourage students to:

- understand and apply the fundamental principles and concepts of Engineering Manufacture, including manufacturing processes, engineering materials, manufacturing requirements and developments in engineering manufacture
- develop learning and practical skills that can be applied to real-life contexts and work situations
- think creatively, innovatively, analytically, logically and critically
- develop independence and confidence in using skills that would be relevant to the engineering, manufacturing, process and control sector and more widely
- plan manufacturing production through practical experience of manufacturing for one-off products and manufacturing in quantity
- determine the sequence of operations required, recognising hazards and risks so that control measures can be implemented for safe working
- interpret engineering drawings to facilitate manufacture, using a range of tools and equipment, including Computer Numerical Control (CNC) machines.

1.4 What are the key features of this specification?

The key features of OCR's Cambridge National in Engineering Manufacture for you and your students are:

- a simple and intuitive assessment model, consisting of an externally assessed unit that focuses on knowledge and understanding and two skills-based, non examined assessment units (NEA)
- a specification developed with teachers specifically for teachers. The specification lays out the subject content clearly
- a flexible support package formed after listening to teachers' needs. The support package will help teachers to easily understand the requirements of the qualification and how it is assessed
- a team of OCR Subject Advisors who support teachers directly and manage the qualification nationally
- the specification has been designed to progress onto Level 3 Vocational Engineering, Design and Technology at A Level, or a range of related Apprenticeships in the sector.

This qualification will help students to develop:

- valuable practical skills in engineering manufacture that are highly sought after in the workplace
- a deep understanding of the processes, materials, tools and equipment used within the engineering, manufacturing, process and control sector.

All Cambridge Nationals qualifications offered by OCR are regulated by Ofqual, the Regulator for qualifications offered in England. The qualification number for OCR's Cambridge National in Engineering Manufacture is QN 603/7087/7.

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2 Qualification overview

2.1 OCR Level 1/Level 2 Cambridge National in Engineering Manufacture at a glance

Qualification number	603/7087/7	**OCR Entry code**	J823
First entry date	01/09/2022	**Approved age range**	14-16
Guided learning hours (GLH)	120	**Performance information**	We've designed this qualification to meet the Department for Education (DfE) requirements for qualifications in the Technical Award category of the 14-16 performance tables.
Total qualification time (TQT)	142		
Offered in	England only	**Eligible for funding**	It's designed to meet the funding requirements of a 14-16 study programme.
This qualification is suitable for students	• aged 14-16 on a full-time study programme wanting to develop applied knowledge and practical skills in engineering manufacture • who want to progress onto other related study, such as qualifications in Engineering or Design and Technology • as it is designed to meet the Department for Education's characteristics for a Technical Award.		
Entry requirements	There is no requirement for students to achieve any specific qualifications before taking this qualification.		
Qualification requirements	Students must complete three units: • one externally assessed unit (exam) - see the Terminal assessment below • two centre-assessed units (NEA).		
Assessment method/ model	Unit R014 is assessed by an exam and marked by us. You will assess the NEA units and we will moderate them. We provide set assignments which must be used to assess the NEA units. Each set assignment will be valid for 1 year. The dates for which they are live are shown on the front cover. You must make sure you use the live assignment for students' assessments and submit in the period in which it is live. You must make sure students have an entry for each series in which you intend to submit or resubmit an NEA unit.		
Assessment series each year	• January • June		
Terminal assessment	The exam must be taken in the final assessment series before qualification certification. If a student retakes their qualification, they will need to resit the exam in order to meet the terminal rule again. The first qualification grade is used for school performance tables even if they have improved their qualification grade.		
Grading	All results are awarded on the following scale: Level 2 – Distinction* (*2), Distinction (D2), Merit (M2), Pass (P2) Level 1 – Distinction (D1), Merit (M1), Pass (P1) and Fail/Unclassified.		
Exam resits	Students can resit the exam. The terminal assessment rule means that the resit result will be used towards the student's final qualification grade and not the best result.		

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Repeat submission of students' NEA work	If students have not performed at their best during the assessment of NEA units, they can improve their work and submit it to you again for assessment. They must have your agreement and you must be sure it is in the student's best interests. We use the term 'resubmission' when referring to student work that has previously been submitted to OCR for moderation. Following OCR moderation a student can attempt to improve their work, for you to assess and provide the final mark to us. There is one resubmission opportunity per NEA assignment. All work submitted (or resubmitted) must be based on the assignment that is live for the series of submission. For information about feedback see section 6. The final piece of work must be completed solely by the student and teachers must not detail specifically what amendments should be made.

2.2 Qualification structure

For this qualification, students must achieve **three** units: one externally assessed and two Non Examined Assessment (NEA) units.

Key to units for this qualification:

M = Mandatory	Students must achieve this unit
E = External assessment	We set and mark the exam
N = NEA	You assess this and we moderate it

Unit no.	Unit title	Unit ref. no. (URN)	Guided learning hours (GLH)	How are they assessed?	Mandatory or optional
R014	Principles of engineering manufacture	R/618/5832	48	E	M
R015	Manufacturing a one-off product	Y/618/5833	36	NEA	M
R016	Manufacturing in quantity	D/618/5834	36	NEA	M

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OCR Level 1/Level 2 Cambridge National in Engineering Manufacture

Qualification number: 603/7087/7

Type of qualification: Technical Award

Purpose Statement

Overview

Who is this qualification for?

The OCR Level 1/Level 2 Cambridge National in Engineering Manufacture is aimed at students aged 14-16 and will develop knowledge, understanding and practical skills that would be used in the engineering, manufacturing, process and control sector.

You may be interested in this if you want an engaging qualification where you will use what you learn in practical, real-life situations, such as:

- The materials used in engineering manufacture
- Safely producing a one-off product
- The use of Computer Numerical Control (CNC) to produce in quantity.

This will help you to develop independence and confidence in using skills that would be relevant to the engineering manufacturing and development sector.

The qualification will also help you to develop learning and skills that can be used in other life and work situations, such as:

- Solving problems by exploring different engineering manufacture processes, tools and equipment
- Planning a sequence of processes. This will involve managing your time and identifying the resources you will need, as well as reviewing your plans if necessary

This qualification will complement other learning that you're completing for GCSEs or vocational qualifications at Key Stage 4 and help to prepare you for further study.

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What will you study as part of the qualification?

You will study the key aspects of engineering manufacture, and have the opportunity to apply what you learn through a number of practical experiences. This will involve you studying three mandatory units:

- **R014: Principles of engineering manufacture**
  This is assessed by an exam.
  In this unit you will learn about the different types of manufacturing processes, and the different materials that can be used within manufacturing.
  Topics include:
  - Manufacturing processes
  - Engineering materials
  - Manufacturing requirements
  - Developments in engineering manufacture.
- **R015: Manufacturing a one-off product**
  This is assessed by a set assignment.
  In this unit you will learn how to safely plan and produce a one-off product by using appropriate processes, tools and equipment.

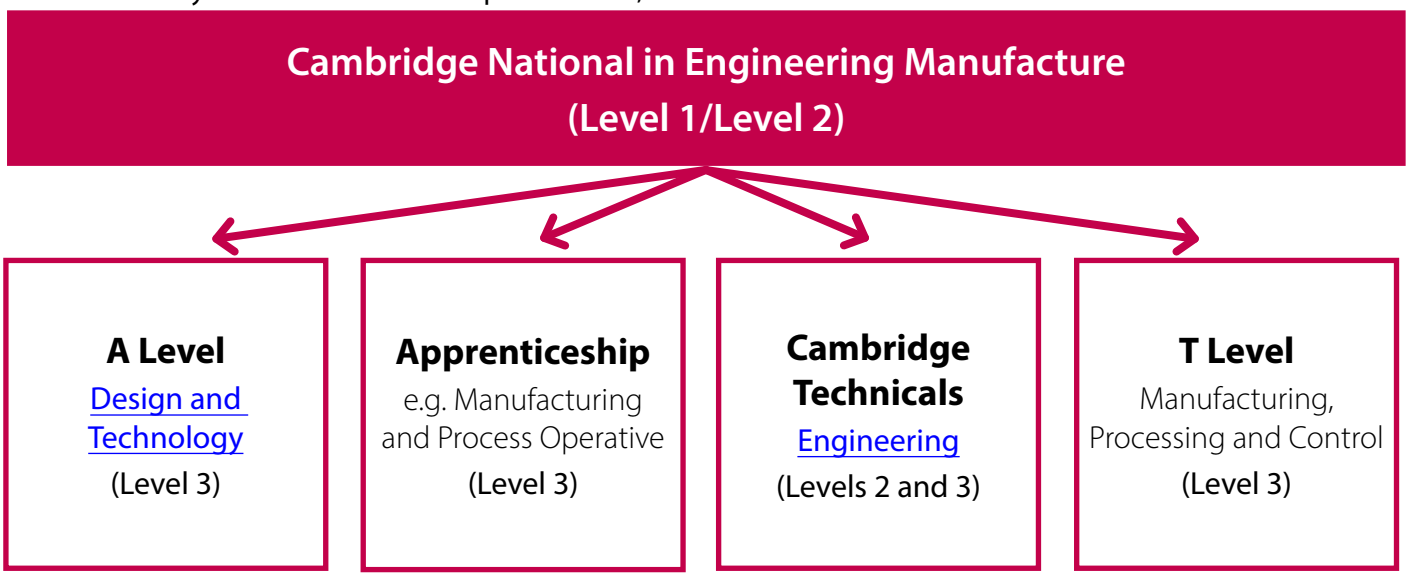
  Topics include:
  - Planning the production of a one-off product
  - Measuring and marking out
  - Safely use processes, tools and equipment to make a product.
- **R016: Manufacturing in quantity**
  This is assessed by a set assignment.
  In this unit you will learn how to manufacture using simple jigs and templates to support manufacturing in volume using Computer Aided Design (CAD) software and Computer Numerical Control (CNC) equipment. Topics include:
  - Preparing for manufacture
  - Develop programmes to operate CNC equipment
  - Safely use processes and equipment to make products in quantity.

What knowledge and skills will you develop as part of this qualification and how might these be of use and value in further studies?

This qualification will enable you to learn about the process of engineering manufacture, and understand the different materials that can be used to manufacture products. You will develop the ability to plan the production of a one-off product using a range of hand-held pieces of equipment and machining methods. You will also learn how to program CNC equipment to manufacture.

These skills will help you progress onto further study in the engineering, manufacturing, process and control sector. This may be Level 3 vocational qualifications, such as the Cambridge Technical in Engineering, A-Levels, such as A-Level Design and Technology, or one of the number of Fabrication and Welding Operative/Technician or Manufacturing and Process Operative Apprenticeships. It is anticipated that these qualifications will also enable you to progress onto a T Level such as Manufacturing, Processing and Control when they are available.

The diagram below shows the possible progression routes for your further study:



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Which subjects will complement this course?

Other subjects that supplement or complement this qualifications include:

- Cambridge National in Engineering Design
- Cambridge National in Engineering Programmable Systems
- GCSE Design and Technology
- GCSE Science.

Further details

More information about the Cambridge National in Engineering Manufacture can be found in these documents:

Specification

Sample Assessment Material (SAM)

Guide to our Sample Assessment Material

Student guide to NEA assignments

Understanding the assessment: examined and moderated

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3 About this qualification

3.1 Qualification size (GLH and TQT)

The size of the qualification is described in terms of Guided Learning Hours (GLH) and Total Qualification Time (TQT).

GLH indicates the approximate time (in hours) the teacher will spend supervising or directing study and assessment activities. We have worked with people who are experienced in delivering related qualifications to determine the content that needs to be taught and how long it will take to deliver.

TQT includes two parts:

- GLH
- an estimate of the number of hours a student will spend on unsupervised learning or assessment activities (including homework) to successfully achieve their qualification.

OCR Level 1/Level 2 Cambridge National in Engineering Manufacture is 120 GLH and 142 TQT.

3.2 Language

This qualification is available in English only. All assessment materials are available in English only and all candidate work must be in English.

3.3 Availability

The Cambridge Nationals qualifications are available in England. They are **not** available in Wales or Northern Ireland.

3.4 Performance information

We've designed this qualification to meet the Department for Education (DfE) requirements for qualifications in the Technical Award category of the 14-16 performance tables.

You'll find information on performance tables for England on the Department for Education website.

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4 Units

4.1 Guidance on unit content

This section describes what must be taught so that students can access all available marks.

4.1.1 Terminal Assessment Rule

The terminal assessment rule means that students must take their exam in the final assessment series of their course. You should be mindful of this when entering students for units. See Section 7.3 for more information.

4.1.2 Externally assessed unit (R014)

The externally assessed unit is made up of a number of topic areas. Each topic area has related teaching content that must be taught. A direct question may be asked about any content in the teaching content column.

The breadth and depth column helps to clarify the breadth and depth of teaching needed, and indicates the range of knowledge and understanding that may be assessed in the exam. This column also confirms any aspects that you do **not** need to teach in relation to the content as 'does not include' statements.

Knowledge and understanding

Students will need to **understand** the content unless the breadth and depth column identifies it as knowledge only.

- Any item(s) that should be taught as knowledge only will start with the word 'know' in the breadth and depth column.
- All other content is expected to be taught as understanding.

The table below explains what we mean by knowledge and understanding.

Knowledge	• Be able to identify or recognise a given item, for example on a diagram • Use direct recall to answer a question, for example the definition of a term.
Understanding	• To assess and evidence the perceived meaning of something in greater depth than straight identification or recall. • Understanding will be expressed and presented using terms such as: how; why; when; reasons for; benefits and drawbacks of; advantages and disadvantages of; purpose of; suitability of; recommendations for improvement; pros and cons; appropriateness of something to/in different contexts.

Students need to be taught the information in both the teaching content and breadth and depth columns.

4.1.3 NEA Units (R015 and R016)

The NEA units are made up of a number of topic areas with associated teaching content which details what must be taught as part of each topic area. The NEA units also have an exemplification column that provides more information about, and examples relating to, the teaching content. This helps to exemplify the teaching expected so that students are equipped to successfully complete their assignments.

4.1.4 Command and descriptor words

Appendix B gives information about the expectations of the command words that will be used in the external assessments and the descriptor words that will be used in the NEA marking criteria.

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4.1.5 Performance Objectives (POs):

Each Cambridge National qualification has related Performance Objectives. There are four Performance Objectives in the OCR Level 1/Level 2 Cambridge National in Engineering Manufacture.

Performance Objectives	
PO1	Recall knowledge and show understanding
PO2	Apply knowledge and understanding
PO3	Analyse and evaluate knowledge, understanding and performance
PO4	Demonstrate and apply skills and processes relevant to the subject area

PO1 is only relevant to the exam. PO4 is only relevant to the NEA assessments.

The weightings of the Performance Objectives across the units is:

Performance Objective	Externally assessed unit (range)	NEA units	Overall weighting
PO1	16.5%–20%	n/a	16.5%–20%
PO2	15%–19%	18.5%	33.5%–37.5%
PO3	6%–8%	14%	20%–22%
PO4	n/a	27.5%	27.5%
Overall weighting of assessments	**40%**	**60%**	**100%**

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4.2 Unit R014: Principles of engineering manufacture

Aims

Products are manufactured using a wide variety of processes and materials. In order to understand the manufacturing requirements for products, it is important to consider the requirements presented by the product design, the scale of manufacture, and the quality requirements that have been set out.

In this unit you will learn about the different types of manufacturing processes, the materials that can be used to manufacture products using these processes, and the factors to be considered when determining the manufacturing requirements of an engineered product. You will consider the different types of manufacturing process that are typically used in engineering, using specific examples of each process type. The engineering materials include ferrous and non-ferrous metals, polymers, ceramics, composites, and smart materials. You will understand how the properties of these materials relate to their manufacturing characteristics. In addition you will also develop an understanding of some of the current developments in engineering manufacture.

Unit R014: Principles of engineering manufacture

Topic Area 1: Manufacturing processes

Teaching content	Breadth and Depth
1.1 Types of manufacturing processes	
1.1.1 The types of manufacturing processes □ Wasting □ Shaping □ Forming □ Additive processes □ Joining □ Finishing	To include: • Recommend with justification the most appropriate process to create a manufactured form
1.1.2 How each process type changes the form of materials to create a product	
1.2 Details of different manufacturing processes	
1.2.1 Wasting processes □ Sawing □ Shearing □ Drilling □ Filing □ Threading □ Routing □ Laser-cutting □ Turning □ Milling	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures • Shearing is restricted to manual use of a guillotine and tin snips • Threading is restricted to manually using a tap and die

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Unit R014: Principles of engineering manufacture

1.2.2 Shaping processes: □ Sand casting □ Die casting □ Injection moulding □ Powder metallurgy for ceramic product	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures • Differences between sand and die casting, including the types of mould used
1.2.3 Forming processes □ Forging □ Press forming metal □ Strip heating of polymers □ Vacuum forming □ Moulding of composite materials	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures • The characteristics of vacuum forming moulds
1.2.4 Additive manufacturing □ 3D Printing (fused deposition modelling)	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures
1.2.5 Joining processes □ Brazing □ MIG/MAG welding □ Riveting ▪ hammered rivets ▪ pop rivets □ Mechanical fastening ▪ nuts and bolts ▪ self-tapping screws	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures • The relative characteristics of different methods of joining
1.2.6 Finishing processes □ Painting ▪ brush ▪ spray □ Powder coating	To include: • Tools and equipment required • Steps carried out to manufacture a product • Safety measures

Topic Area 2: Engineering materials

Teaching content	Breadth and Depth
2.1 Mechanical properties of materials	
□ Strength ▪ yield/tensile ▪ compressive □ Elasticity □ Ductility □ Hardness	To include: • Definitions of the properties
2.2 Other properties influencing manufacturing	
□ Malleability □ Machinability □ Cost ▪ material ▪ manufacturing □ Sustainability	To include: • Definitions of the properties

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Unit R014: Principles of engineering manufacture

2.3 Types of engineering materials and how they are processed

2.3.1 Metals: □ Difference between pure metals and alloys □ Types of ferrous metal ▪ cast iron ▪ low carbon steel ▪ high carbon steel ▪ stainless steel □ Types of non-ferrous metal ▪ aluminium and alloys ▪ copper, brass and bronze	To include: • The relative properties, typical forms of supply and common applications of the different materials
2.3.2 Polymers: □ Difference between thermoplastic and thermosetting polymers □ Types of thermoplastic polymer ▪ Acrylonitrile-Butadiene-Styrene (ABS) ▪ High Impact Polystyrene (HIPS) ▪ Polymethylmethacrylate (PMMA/Acrylic) ▪ Polycarbonate ▪ Polylactic acid (PLA) □ Types of thermosetting polymer: ▪ urea formaldehyde ▪ melamine formaldehyde ▪ epoxy resin ▪ polyester resin	To include: • The relative properties, typical forms of supply and common applications of the different materials
2.3.3 Engineering ceramics □ Types of engineering ceramic ▪ silicon carbide ▪ tungsten carbide ▪ silicate glass	To include: • The relative properties, typical forms of supply and common applications of the different materials
2.3.4 Composite materials □ Difference between metal alloys and composite materials □ Types of composite material ▪ glass reinforced polymer (GRP/fibreglass) ▪ carbon reinforced polymer (CRP)	To include: • The relative properties, typical forms of supply and common applications of the different materials
2.3.5 Smart materials □ Definition of a smart material □ Types of smart material ▪ shape memory alloy (SMA) ▪ thermochromic pigment ▪ photochromic pigment ▪ Quantum Tunnelling Composite (QTC)	To include: • The relative properties, typical forms of supply and common applications of the different materials

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Unit R014: Principles of engineering manufacture

Topic Area 3: Manufacturing requirements

Teaching content	Breadth and Depth
3.1 Interpreting orthographic third angle projection drawings	
□ Meaning of line types: ▪ outlines ▪ hidden detail ▪ centreline ▪ projection ▪ dimension ▪ leader line □ Standard conventions for dimensions ▪ linear measurements ▪ radius ▪ diameter ▪ tolerances ▪ surface finish □ Abbreviations ▪ across flats ▪ centre line ▪ diameter ▪ drawing ▪ material ▪ square □ Representation of mechanical features ▪ threads ▪ holes ▪ chamfers ▪ countersinks ▪ knurls	To include: • Standard conventions in BS 8888 and how these are applied • Calculation of maximum and minimum acceptable dimensions from a stated tolerance
3.2 Influence of the scale of manufacture on the production method	
□ Scales of manufacture ▪ one-off ▪ batch ▪ mass □ Advantages and limitations of jigs, fixtures, templates and moulds □ Level of automation ▪ manual control ▪ CAM processes ▪ fully automated robotic control □ Advantages and limitations of using CAM machines to manufacture parts	To include: • Typical products manufactured at different scales of manufacture • Typical products manufactured using different levels of automation • Advantages and limitations of using CAM including: ○ improved consistency of products ○ reduction in defects ○ ability to accurately manufacture complex parts ○ greater rate of production ○ ability of automated systems to work in environments that would be hazardous to operators ○ initial capital outlay ○ influence on employment opportunities

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Unit R014: Principles of engineering manufacture

3.3 Quality

□ Reasons for implementing a quality system in engineering ▪ early intercept of problems in production ▪ reducing waste and associated costs ▪ consistency of finished products ▪ conformity to industry standards and regulations ▪ reduce issues at customer and returns □ Quality control as a reactive approach, measuring parts □ Quality assurance as a preventative approach putting in place systems to reduce occurrence of defects	To include: • The difference between quality control and quality assurance

Topic Area 4: Developments in engineering manufacture

Teaching content	Breadth and Depth
4.1 Inventory management	
□ Just in time (JIT) manufacturing □ Material requirements planning (MRP)	To include: • Definitions • The advantages and disadvantages
4.2 Lean manufacturing	
□ The seven categories of waste ▪ transportation ▪ inventory ▪ movement ▪ waiting ▪ over-processing ▪ over-production ▪ defects □ How reducing each waste improves the performance of manufacturing	
4.3 Globalisation	
□ Requirement for transportation □ International standards □ Influence on employment opportunities □ Differences in employment conditions □ Influence on product cost □ Implications for sustainability □ Consideration of economic, social, ethical and environmental implications	

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Assessment guidance

This unit is assessed by an exam. Due to the Terminal Assessment requirement, the exam must be taken in the students' final assessment series. The exam is 1 hour 15 minutes. It has two Sections – Section A and Section B.

- Section A has 10 marks
- Section B has 60 marks
- The exam has 70 marks in total

This will be conducted under examination conditions. For more details refer to the Administration area.

The Engineering Manufacture 'Exploring our exams: a guide to our sample assessment material' gives more information about the layout and expectations of the exam.

A range of question types will be used in the exam, but it will always require students to use the skills of analysis and evaluation.

Teaching content	
1.1	• Students will need to be able to describe how each type of process changes the form of materials and to recommend the process types that would be necessary to create an identified product.
1.2.1 – 1.2.6	• Students will need to be able to identify the equipment and tools used to carry out the processes, describe the stages involved in carrying out each process using the equipment and explain the safety considerations when using the equipment. • Students are not expected to be able to use the processes in this unit, as this covers the principles of use
2.1 - 2.2	• Students will need to know the definitions of the properties.
2.3	• Students will need to know the materials, their relative properties, typical forms of supply, at least one common application for each material and the processes that can be used with each material. They are not expected to suggest materials for applications based on their properties
3.1	• Students may be expected to identify each of the conventions or representations stated. • Students may also be expected to add dimensions using the conventions to provided drawings. • Students are not expected to create new drawings.
3.2	• Students should know at least one example of a product produced at each scale of manufacture and at least one example of a product produced using each different level of automation.

Synoptic assessment

This unit allows students to gain underpinning knowledge and understanding relevant to the qualification and sector. The NEA units draw on and strengthen this learning with students applying their learning in a practical, skills-based way. The synoptic grids at the end of the NEA units show these synoptic links.

More information about synoptic assessment within this qualification can be found in section 5.2 synoptic assessment.

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4.3 Unit R015: Manufacturing a one-off product

Aims

There is often a need to manufacture one-off products in engineering. This might be for a unique application or product, or there may be a need to manufacture replacements for failed items. In addition, there will often be the need to produce a prototype in order to evaluate a design.

In this unit you will learn to identify the information required to make a product, plan the production of a product and carry out risk assessments for the processes, tools and equipment needed to produce a product in small quantities. You will also learn how to select and safely use the equipment, processes and tools required to mark out, measure and manufacture a product in small quantities, using a range of hand-held equipment and conventional (non-Computer Numerical Control (CNC) machining methods.

Unit R015: Manufacturing a one-off product

Topic Area 1: Planning the production of a one-off product

Teaching content	Exemplification
1.1 Interpret an engineering drawing to identify information to facilitate manufacture	
□ Identify required form and mechanical features ▪ threads ▪ holes ▪ chamfers ▪ countersinks ▪ knurls □ Identify required dimensions and characteristics: ▪ linear measurements ▪ radius ▪ diameter ▪ tolerances □ Surface finish	To include: • Engineering drawings in third angle orthographic projection using standard conventions • Three-dimensional components where there are dimension changes, tapers or steps along the form • Mechanical features
1.2 Prepare a production plan to manufacture a one-off product	
□ Materials required □ Processes, tools and equipment required □ Sequence of operations □ Health and safety considerations □ Quality control requirements	
1.3 Carry out a risk assessment	
□ Identify hazards (potential sources of harm) □ Identify risks (the probability of a hazard occurring) □ Identify control measures	

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Unit R015: Manufacturing a one-off product

Topic Area 2: Measuring and marking out

Teaching content	Exemplification
2.1 Select and safely use equipment for marking out	
2.1.1 Equipment □ Rules □ Dividers □ Scribers □ Scribing blocks □ Surface plates □ Punches □ Squares □ Protractors □ Angle plates	To include: • Which features each tool uses to mark out
2.1.2 Marking out techniques □ Datum □ Centre lines □ Profiles: ▪ square/rectangular ▪ angular ▪ radial □ Circles □ Hole positions	
2.2 Select and use measuring instruments	
□ Rules □ Digital Vernier callipers ▪ external ▪ internal ▪ depth □ Micrometres ▪ external ▪ internal ▪ depth □ Squares □ Protractors □ Height gauge □ Dial Test Indicator (DTI)	To include: • Which types of dimensions are measured using each instrument

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Unit R015: Manufacturing a one-off product

Topic Area 3: Safely use processes, tools and equipment to make a product

Teaching content	Exemplification
3.1 Manually controlled machining processes	
□ Drilling □ Turning using a centre lathe □ Milling	To include: • Setting and operation of the stated machines • For the lathe, end facing, parallel turning, centre drilling, knurling and parting off • For the mill, grooves, facing and slotting
3.2 Tools and equipment	
□ Saws ▪ hacksaw ▪ junior hacksaw □ Guillotine □ Files □ Tap and die □ Press (sheet bending)	
3.3 Joining techniques	
□ Brazing □ Pop-rivets □ Mechanical fastenings ▪ nuts and bolts ▪ self-tapping screws	

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Marking criteria

Section 6.4 provides full information on how to mark the NEA units and apply the marking criteria. The marking criteria descriptor words are further explained in Appendix B .

The tables below contain the marking criteria for the tasks for this unit. If a student's work does not meet any Mark Band 1 (MB1) criteria for the task, you must award zero marks for that task.

Unit R015 – Topic Area 1.1, 1.2: Interpret an engineering drawing and prepare a production plan		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
A **basic** plan that includes information that could be used when making the product, however additional content would be required to facilitate manufacture.	An **adequate** plan that includes information that could be used when making the product to facilitate manufacture.	A **comprehensive** plan that includes all the information required to facilitate manufacture of the product.
A **few** of the materials needed are identified.	**Some** of the materials needed are identified.	**All** materials needed are accurately identified.
Few suitable processes, tools and equipment are identified.	**Some** of the processes, tools and equipment are suitable and presented in a workable sequence.	**All** processes, tools and equipment are appropriate and presented in a logical sequence.
Few health and safety issues have been considered.	**Some** health and safety issues have been considered.	**All** health and safety issues have been considered.
At least **one** quality control measure has been identified.	**Some** quality control measures identified.	**Appropriate** quality control measures identified to support the manufacture of an **effective** outcome.

Unit R015 – Topic Area 1.3: Risk assessment		
MB1: 1–2 marks	**MB2: 3–4 marks**	**MB3: 5–6 marks**
At least **one** potential hazard is identified and the risk of occurrence estimated.	**Some** potential hazards are identified and the risk of occurrence for each is estimated.	**All** of the potential hazards of the process are identified and the risk of occurrence for each is estimated.
At least **one** control measure has been identified.	Appropriate control measures identified for **some** of the hazards.	Appropriate control measures identified for **all** of the hazards.

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Unit R015 – Topic Areas 2.1 and 2.2: Measuring and marking out		
MB1: 1–4 marks	**MB2: 5–8 marks**	**MB3: 9–12 marks**
Use at least **one** item of measuring equipment. Safely use a **few** items of marking out equipment. **Dependent** upon assistance or help from other sources to measure and mark out accurately.	Select and use **some** appropriate items of measuring equipment. Select and safely use marking out equipment for **some** of the features. Accurate measuring and marking out is carried out with **some** assistance or help from other sources.	**All** measuring equipment is selected and used appropriately. Select and safely use appropriate marking out equipment for **all** of the features. Able to accurately measure and mark out **independently**.

Unit R015 – Topic Area 3.1: Manually controlled machining processes		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
Dependent upon reminders of safety requirements in order to work safely. **Basic** application of understanding and skills to partly achieve the intended result, but it would not be useable without further input/work. **Dependent** upon assistance or help from other sources to use machinery to successfully manufacture the required part.	Worked safely with some reminders of safety requirements. **Adequate** application of understanding and skills to produce the intended result in a way that would be useable for its purpose. Machinery is used to successfully manufacture the required part with **some** assistance or help from other sources.	Worked safely at **all** times without additional instruction. **Effectively** applies understanding and skills to successfully produce the intended result in a way that would be fit-for-purpose. Able to use machinery to successfully manufacture the required part **independently**.

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Unit R015 – Topic Area 3.2 and 3.3: Tools and equipment and joining techniques		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
Dependent upon reminders of safety requirements in order to work safely.	Worked safely with **some** reminders of safety requirements.	Worked safely at **all** times without additional instruction.
Basic application of understanding and skills to partly achieve the intended result, but it would not be useable without further input/work.	**Adequate** application of understanding and skills to produce the intended result in a way that would be useable for its purpose.	**Effectively** applies understanding and skills to successfully produce the intended result in a way that would be fit-for-purpose.
Dependent upon assistance or help from other sources to use tools and equipment to successfully manufacture the part(s) and assemble the product.	Tools and equipment are used to successfully manufacture the part(s) and assemble the product. with **some** assistance or help from other sources.	Able to use tools and equipment **independently** to successfully manufacture the part(s) and assemble the product..

Assessment guidance

Task	Assessment guidance
Task 1	• You should ensure that students have the opportunity to carry out relevant supporting research, which might be achieved by access to the internet. • Please remind students about the requirement to reference all sources. • Any appropriate format can be used for the production plan, so long as the information required to facilitate manufacture is presented. • Students are not expected to produce working drawings of the part to be manufactured.
Task 2	• The assessment of risk can be either qualitative (e.g. high, low, medium) or quantitative. • Students can use any appropriate formats for the risk assessment., but we do provide a template that students can use.
Task 3	• Students should be able to identify, select and use appropriate equipment to mark out and measure the features of the product. No tolerances are specified as these will be dependent upon the resources available in individual centres. • Students may wish to collate annotated images in the form of a practical diary as part of their evidence. This should be completed individually, so it would be highly unusual to see the same output from all students in a cohort. • You must make a note on the Unit Recording Sheet (URS) of any assistance students required to accurately measure and mark out features of the product.
Task 4	• No tolerances are specified as these will be dependent upon the resources available in individual centres. • Students should collate annotated images in the form of a practical diary as part of their evidence. This should be completed individually, so it would be highly unusual to see the same output from all students in a cohort. • Students must follow safe working practices at all times. • You should complete a Teacher Observation Record for this task.

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Task	Assessment guidance
Task 5	• No tolerances are specified as these will be dependent upon the resources available in individual centres. • Students may wish to collate annotated images in the form of a practical diary as part of their evidence. This should be completed individually, so it would be highly unusual to see the same output from all students in a cohort. • Students must follow safe working practices at all times. • You should complete a Teacher Observation Record for this task.

Synoptic assessment

Some of the knowledge, understanding and skills required when completing this unit will draw on the learning developed in Unit R014. The following table details where these synoptic links can be found:

R015: Manufacturing a one-off product		R014: Principles of engineering design	
Topic area		**Topic area**	
1	Planning the production of a one-off product	1	Manufacturing processes
		2	Engineering materials
		3	Manufacturing requirements
3	Safely use processes, tools and equipment to make a product	1	Manufacturing processes

More information about synoptic assessment within this qualification can be found in section 5.2 Synoptic assessment.

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4.4 Unit R016: Manufacturing in quantity

Aims

Most products are produced for a commercial environment. This often means that they will need to be produced in large quantities to a consistent standard. To help achieve this, manufacturing in quantity will make use of Computer Aided Design/ Computer Aided Manufacture (CAD/CAM) facilities.

In this unit you will learn how to manufacture and use simple jigs and templates to support manufacturing in volume. By using CAD software you will learn about the information needed to facilitate manufacture, and apply this in order to program Computer Numerical Control (CNC) equipment. In addition, you will learn how to set up and operate the CNC equipment and monitor the quality of the manufactured products.

Unit R016: Manufacturing in quantity

Topic Area 1: Preparing for manufacture

Teaching content	Exemplification
1.1 Manufacture and use production aids	
□ Manufacture and use: ▪ jigs ▪ templates ▪ Go-No Go gauges	To include: • The typical uses of these items, such as work holding and quality control • The use of card to make templates • Use of third-angle orthographic projection drawings to create CAD drawings to manufacture 2D shapes using CNC equipment
1.2 Sequence of operations	
□ Determine the sequence of operations required for a manufactured part	To include: • Parts that can be manufactured using at least one Computer Numerical Control (CNC) process
1.3 Operating parameters	
□ Determine appropriate operating parameters for Computer Numerical Control (CNC) equipment	To include: • Use of manufacturers manuals or other published sources • Outputs of CAD software and simulation
1.4 Standard operating procedures (SOPs)	
□ Produce standard operating procedures (SOPs) for the use of manufacturing processes	

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Unit R016: Manufacturing in quantity

Topic Area 2: Develop programmes to operate CNC equipment

Teaching content	Exemplification
2.1 Use Computer Aided Design (CAD) software	
□ Use provided CAD drawings to create working drawings suitable for the CNC manufacture of parts □ Carry out on-screen simulation of CNC operations	To include: • Use 3D CAD models to create instructions to manufacture parts by turning or 3D printing • Use of suitable documentation to demonstrate the simulation or animation of the CNC operation Examples of on-screen **simulation** or **physical operation simulation** of CNC operations may include: • Simulation of the cutting tool in operation • Simulation of materials deposition • Simulation of the laser cutter in operation
2.2 Programme CNC machine operations	
□ Setting datum points □ Use of co-ordinates □ Sequence of operations □ Tool change-over □ Setting tool offsets □ Export information from CAD software to CNC machines	To include: • Recognition that some programming requirements are specific to certain CNC processes • The difference between absolute and incremental co-ordinates

Topic Area 3: Safely use processes and equipment to make products in quantity

Teaching content	Exemplification
3.1 Setting up of CNC equipment	
□ Tooling □ Work holding □ Setting datum points □ Safety procedures	Examples of **manufacturing processes** may include: • The types of processes used could include: ○ laser cutters ○ CNC lathes ○ CNC routers ○ 3D printers
3.2 Operating CNC equipment	
□ Operate CNC equipment safely	
3.3 Apply quality control methods for volume manufacture	
□ Use Go-No Go Gauges □ Comparison of dimensional characteristics against engineering drawings	To include: • Measurement of linear and angular dimensions using appropriate devices

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Marking criteria

Section 6.4 provides full information on how to mark the NEA units and apply the marking criteria. The marking criteria descriptor words are further explained in Appendix B.

The tables below contain the marking criteria for the tasks for this unit. If a student's work does not meet any Mark Band 1 (MB1) criteria for the task, you must award zero marks for that task.

Unit R016 – Topic Area 1.1: Manufacture and use templates		
MB1: 1–2 marks	**MB2: 3–4 marks**	**MB3: 5–6 marks**
Basic application of understanding and skills to partly achieve the intended result, but it would not be useable without further input/work. Dependent upon assistance or help from other sources to measure, mark out and cut out templates for the parts accurately.	**Adequate** application of understanding and skills to produce the intended result in a way that would be useable for its purpose. Accurate templates are measured, marked out and cut out with **some** assistance or help from other sources.	**Effectively** applies understanding and skills to successfully produce the intended result in a way that would be fit-for-purpose. Able to accurately measure, mark out and cut out templates for the parts **independently**.

Unit R016 – Topic Areas 1.2, 1.3 and 1.4: Determine the sequence of operations, appropriate operating parameters for CNC equipment and produce standard operating procedures		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
The SOP includes **basic** information, however additional content would be required.	The SOP includes **adequate** information to make the product.	The SOP produced includes **all** the information required to manufacture the product.
Few of the operations required are identified but additions may be needed and the sequence may need adjustment to be workable.	**Some** of the operations required are identified. The sequence of operations may need minor adjustment to be a workable sequence.	**All** of the operations required are identified in a logical and workable sequence.
Few of the operating parameters for the CNC equipment are identified, however would not provide a satisfactory outcome without further input/work.	**Some** of the operating parameters for the CNC equipment are identified and should provide a satisfactory outcome with minimal adjustment.	**All** of the operating parameters for the CNC equipment are identified and appropriate and should provide a satisfactory outcome without adjustment.

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Unit R016 – Topic Areas 2.1 and 2.2: Use CAD software and program CNC machine operations		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
Produces **basic** CAD drawings that include some relevant information however some additional features would be required to create instructions for the CNC operation.	Produces **adequate** CAD drawings that include most of the information required to create instructions for the CNC operation.	Produces **comprehensive** CAD drawings that are accurate and include all of the information required to create instructions for the CNC operation.
Carries out on-screen simulation of **few** aspects of the CNC operation.	Carries out on-screen simulation of **most** aspects of the CNC operation.	Carries out an **effective** on-screen simulation of the CNC operation, making adjustments if required.
Limited application of understanding and skills to partly achieve the intended result, but information is not exported from the CAD software to the CNC equipment.	Understanding and skills are used to **partially** export the information from CAD software to CNC equipment that does not fully meet the requirements.	Understanding and skills are used to **fully** export the information from CAD software to CNC equipment in a way that would be fit-for-purpose.

Unit R016 – Topic Areas 3.1 and 3.2: Setting up and operating CNC equipment		
MB1: 1–5 marks	**MB2: 6–10 marks**	**MB3: 11–14 marks**
Dependent upon reminders of safety requirements in order to work safely.	Worked safely with **some** reminders of safety requirements.	Worked safely at **all** times without additional instruction.
Basic application of understanding and skills to partly achieve the intended result, but it would not be useable without further input/work.	**Adequate** application of understanding and skills to produce the intended result in a way that would be useable.	**Effectively** applies understanding and skills to successfully produce the intended result in a way that would be fully fit-for-purpose.
Dependent upon assistance or help from other sources to set up and operate CNC equipment to successfully manufacture the part(s).	**Some** assistance or help from other sources is required to set up and operate CNC equipment to successfully manufacture the part(s).	Able to set up and operate CNC equipment **independently** to successfully manufacture the part(s).

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Unit R016 – Topic Area 3.3: Apply quality control methods		
MB1: 1–4 marks	**MB2: 5–8 marks**	**MB3: 9–12 marks**
Measured **few** of the features on the drawing although some methods may have not been the most appropriate. **Basic** application of understanding and skills to partly achieve the intended result, but it would not be useable without further input/work.	Measured **some** of the features on the drawing using appropriate methods. **Adequate** application of understanding and skills to produce the intended result in a way that would be useable.	Provided accurate and repeatable measurements of **all** of the features on the drawing using appropriate methods. **Effectively** applies understanding and skills to successfully produce the intended result in a way that would be fully fit-for-purpose.

Assessment guidance

Task	Assessment guidance
Task 1	• Students are expected to manufacture at least one basic production aid. Any appropriate material can be used for to manufacture this items, including card or a thin sheet of polymer. The process used could be manual, such as scissors, craft knives or similar and the processes used can be either CNC or manually controlled. • You must make a note on the Unit Recording Sheet (URS) of any assistance students required to accurately measure, mark out and cut out templates.
Task 2	• You should ensure that students have the opportunity to carry out relevant supporting research for the operating parameters of the equipment – this might be achieved by access to manufacturers manuals or the internet. • Please remind students about the requirement to reference all sources. • Any appropriate formats can be used for the standard operating procedure.
Task 3	• Students should be able to use a provided drawing to create a working drawing with sufficient information for the CNC manufacturing operation. • Evidence must include copies of the CAD drawings, the instructions or program created by the CAD software for the CNC machine, and screenshots of the on-screen simulation and data transfer. • The on-screen simulation can be carried out using a separate CAD software package or an animation of the operation. If an on-screen simulation is not available students can evidence this task with a video of a practice operation.
Task 4	• Students are required to set up and operate a CNC process/equipment. OCR does not specify the manufacturing process/equipment to use for the set assignment, but the minimum resource requirement is to have access to 3D printers and laser cutters. • Evidence could be collated in the form of a practical diary, that contains annotated photographs. This should be completed individually, so it would be highly unusual to see the same output from all students in a cohort. • You should complete a Teacher Observation Record for this task.

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Task	Assessment guidance
Task 5	• Students must be able to enter data onto a control chart and identify when intervention is required. • Students are not required to create control charts or calculate process capabilities, action limits or control limits. • Evidence must include images of the parts compared to the templates and the assembled product. • The comparison of the dimensions of the parts to the engineering drawing could be carried out on a test record sheet or by annotating the drawings.

Synoptic assessment

Some of the knowledge, understanding and skills required when completing this unit will draw on the learning developed in Unit R014. The following table details where these synoptic links can be found:

R016: Manufacturing in quantity		R014: Principles of engineering design	
Topic area		**Topic area**	
1	Preparing for manufacture	1	Manufacturing processes
		3	Manufacturing requirements
2	Develop programmes to operate CNC equipment	3	Manufacturing requirements
3	Safely use processes and equipment to make products in quantity	1	Manufacturing processes
		3	Manufacturing requirements

More information about synoptic assessment within this qualification can be found in section 5.2 Synoptic assessment.

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5 Assessment and grading

5.1 Overview of the assessment

Entry code	Qualification title	GLH	Reference
J823	**OCR Level 1/Level 2 Cambridge National in Engineering Manufacture**	**120***	**603/7087/7**
Made up of three mandatory units: • Units R014, R015 and R016.			

*the GLH includes assessment time for each unit

Unit R014: Principles of engineering manufacture	
48 GLH 1 hour 15 minute written examination 70 marks (80 UMS) OCR-set and marked Calculators are allowed in this exam	This question paper has two parts: • Part A – includes 10 multiple choice questions (MCQs) • Part B – includes short answer questions and extended response questions. One extended response question will be assessed using a levels of response mark scheme.
Unit R015: Manufacturing a one-off product	
36 GLH OCR-set assignment 60 marks (60 UMS) Centre-assessed and OCR moderated	This set assignment contains 5 practical tasks. It should take approximately 10-12 GLH to complete.
Unit R016: Manufacturing in quantity	
36 GLH OCR-set assignment 60 marks (60 UMS) Centre-assessed and OCR moderated	This set assignment contains 5 practical tasks. It should take approximately 10-12 GLH to complete.

The terminal assessment rule or 'terminal rule' means that the exam must be taken in the final assessment series of the student's course. Non examined assessment (NEA) units can be submitted in the same series as the exam or an earlier series but the exam must be taken in the final series.

If a student takes the exam in a series before their work for NEA units are submitted, this is considered as a 'practice' attempt and will not contribute to their final qualification grade. The student must take their exam again in their final assessment series and that exam result will be used towards the student's final qualification grade.

For more information on the terminal rule and also what it means for performance tables see Section 7.3. Resitting units before certification and Retaking the qualification.

OCR-set assignments for units R015 and R016 are available on our secure website for teachers, Teach Cambridge.

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5.2 Synoptic assessment

Synoptic assessment is a built-in feature of this qualification. It means that students need to use an appropriate selection of their knowledge, understanding and skills developed across the qualification in an integrated way and apply them to a key task or tasks.

This also helps students to build a holistic understanding of the subject and the connections between different elements of learning, so they can go on to apply what they learn from this qualification to new and different situations and contexts.

The externally assessed unit R014 allows students to gain underpinning knowledge and understanding relevant to engineering, manufacturing, process and control, and the non examined assessment (NEA) units R015 and R016 draw on and strengthen this learning by letting students apply their learning in a practical, skills-based way, through the scaling up of manufacture.

It is important to be aware of the synoptic links between the units so that teaching, learning and assessment can be planned accordingly. Then students can apply their learning in ways which show they are able to make connections across the qualification when they are assessed.

5.3 Transferable skills

This qualification also allows students the opportunity to gain broad, transferable skills and experiences that can be applied as they progress into their next stages of study and life and to enhance their preparation for future employment.

Students will have the opportunity to develop and demonstrate the following skills that are transferable to different real-life contexts, roles or employment:

- Solving problems by exploring different engineering manufacture processes, tools and equipment
- Planning a sequence of processes. This will involve managing your time and identifying the resources you will need, as well as reviewing your plans if necessary.

Planning as part of a project is an important skill for any engineering workplace. Its helps businesses to prioritise and improve productivity and efficiencies. Good planning can also help develop time management skills.

Through the requirement to prepare a production plan students will also have the opportunity to identify what is needed, and the resources that will be required.

5.4 Grading and awarding grades

All results are awarded on the following scale:

- Distinction* at Level 2 (*2)
- Distinction at Level 2 (D2)
- Merit at Level 2 (M2)
- Pass at Level 2 (P2)
- Distinction at Level 1 (D1)
- Merit at Level 1 (M1)
- Pass at Level 1 (P1).

The shortened format of the grade will show within results files and results reports. However, the full format of the grade will be on the certificates issued to students.

The boundaries for Distinction at Level 2, Pass at Level 2, and Pass at Level 1 are set judgementally. Other grade boundaries are set arithmetically.

The Merit (Level 2) is set at half the distance between the Pass (Level 2) grade and the Distinction (Level 2) grade. Where the gap does not divide equally, the Merit (Level 2) boundary is set at the lower mark (For example, 45.5 would be rounded down to 45).

For the examined unit, the Distinction* (Level 2) grade is normally set at about 0.75 of the D2-M2 distance above the D2 boundary mark.

To set the Distinction (Level 1) and Merit (Level 1) boundaries, the gap between the Pass (Level 1) grade and the Pass (Level 2) grade is divided by 3, and the boundaries set equidistantly. Where this division leaves a remainder of 1, this extra mark will be added to the Distinction (Level 1) to Pass (Level 2) interval, meaning

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the Distinction (Level 1) boundary will be lowered by 1 mark. Where this division leaves a remainder of 2, the extra marks will be added to the Distinction (Level 1) to Pass (Level 2) interval, and the Merit (Level 1) to Distinction (Level 1) interval, meaning the Distinction (Level 1) boundary will be lowered by 1 mark, and the Merit (Level 1) boundary will be lowered by 1 mark.

For example, if Pass (Level 2) is set judgementally at 59, and Pass (Level 1) is set judgementally at 30, then Distinction (Level 1) is set at 49, and Merit (Level 1) is set at 39.

Grades are indicated on qualification certificates. However, results for students who fail to achieve the minimum grade (Pass at Level 1) will be recorded as unclassified (U or u) and **will not** be shown on certificates.

This qualification is unitised. Students can take units across different series and can resit units (see section 7.8 Unit and qualification resits). Grade boundaries are set per unit, per series, so may be set in different places for a unit in different series. When working out students' overall grades, OCR needs to be able to compare performance on the same unit in different series when different grade boundaries may have been set, and between different units. We use a Uniform Mark Scale (UMS) so this can be done.

A student's uniform mark for each unit is calculated from the student's raw mark on that unit. The raw mark boundary marks are converted to the equivalent uniform mark boundary. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the student's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit (for example, 42/60).

The table below shows the Raw marks and UMS marks for each unit:

Marks	Exam	NEA1	NEA2
Raw marks	70	60	60
UMS	80	60	60

The uniform mark boundaries for each of the assessments do not change and are shown below:

Unit GLH	Max Unit Uniform Mark	Unit Grade							
		Distinction* at L2	Distinction at L2	Merit at L2	Pass at L2	Distinction at L1	Merit at L1	Pass at L1	U
36	60	54	48	42	36	30	24	18	**0**
48	80	72	64	56	48	40	32	24	**0**

The student's uniform mark for Unit R014 will be combined with the uniform mark for the NEA units to give a total uniform mark for the qualification. The student's overall grade will be determined by the total uniform mark. The following table shows the minimum total mark for each overall grade:

Max Uniform Mark	Qualification Grade							
	Distinction* at L2	Distinction at L2	Merit at L2	Pass at L2	Distinction at L1	Merit at L1	Pass at L1	U
200	180	160	140	120	100	80	60	**0**

On results day we will publish a marks calculator, for the specific series, on our website to help you convert raw marks/number of achieved criteria into uniform marks.

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5.5 Performance descriptors

Performance descriptors give a general indication of likely levels of attainment by representative students performing at boundaries: Distinction at Level 2, Pass at Level 2 and Pass at Level 1.

Performance descriptor – Distinction at Level 2

Students will be able to:

- recall, select and apply **detailed** knowledge and understanding of engineering
- present information **clearly** and **accurately**, using a **wide range** of technical language and engineering terminology
- apply **relevant** knowledge, understanding and skills in a **range** of situations to plan and carry out investigations and tasks **effectively**, testing their solutions, and working safely and with a **high degree** of **precision**
- analyse and evaluate the evidence available, reviewing and adapting their methods **where appropriate**
- make **reasoned** judgements and **substantiated** conclusions
- work **confidently and independently** to create material which reflects **effective** planning, **skilled** development and **perceptive** evaluation as well as **demonstrating** practical skills at a **high level**.

Performance descriptor – Pass at Level 2

Students will be able to:

- recall, select and apply **sound** knowledge and understanding of engineering
- present information with **some accuracy**, using a **range of** technical language and engineering terminology
- apply knowledge, understanding and skills in a **range** of situations to plan and carry out investigations and tasks, testing their solutions, and working safely and with **precision**
- review evidence available, analysing and evaluating **some** information and making **adequate** adaptations to their methods
- make **judgements** and draw **appropriate** conclusions
- work with some **independence** to create material which reflects **adequate** planning, development and evaluation and an ability to demonstrate **sound** practical skills.

Performance descriptor – Pass at Level 1

Students will be able to:

- recall, select and apply knowledge and understanding of **basic** aspects of engineering
- present **basic** information, using **limited** engineering terminology
- apply **limited** knowledge, understanding and skills to plan and carry out **simple** investigations and tasks, with an awareness of the need for safety and precision
- review evidence and draw **basic** conclusions
- work, with **regular** assistance, to create material which demonstrates a degree of planning, development and evaluation and **limited** practical skills.

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6 Non examined assessment (NEA) units (R015 and R016)

This section provides guidance on the completion of the NEA units (R015 and R016). The NEA units are designed so that students can build a portfolio of evidence to meet the topic areas for the unit.

Assessment for this qualification must adhere to JCQ's Instructions for conducting non-examination assessments (Vocational and Technical Qualifications). Please **do not** use JCQ's Instructions for Conducting Non-examination Assessments (GCE and GCSE Specifications) – these are only relevant to A Level and GCSE specifications.

Units R015 and R016 are centre assessed and externally moderated by us.

You **must** make sure that you have read and understood all of the rules and guidance provided in this section **before** your students complete and you assess the set assignments.

If you have any queries please contact us for help and support.

6.1 Preparing for NEA unit delivery and assessment

6.1.1 Centre and teacher/assessor responsibilities

For the NEA units of this qualification we assume the teacher is the assessor.

Before you plan to get approval from us to offer this qualification you must be confident your centre can fulfil all the responsibilities described below. Once you're approved, you can offer any of our general qualifications, Cambridge Nationals, Cambridge Advanced Nationals or enrichment qualifications without having to seek approval for individual qualifications.

The quality of the delivery of teaching and the integrity of assessments and quality assurance is paramount. Systems must be in place so that assessments are fair, valid, reliable and authentic. One of the key factors behind valid, fair and reliable assessment is the expertise of those doing the assessment and internal quality assurance.

With this in mind, here's a summary of the responsibilities that your centre and teachers must be able to fulfil. It is the responsibility of the head of centre[1] to make sure our requirements are met:

- there are enough trained or qualified people to teach and assess the expected number of students you have in your cohorts and they will complete the **Cambridge Nationals: Essentials for the NEA** online training, prior to assessment of the set assignment. This is available on-demand and accessed through Teach Cambridge or Cambridge OCR Train
- teaching staff have the relevant level of subject knowledge and skills to deliver and assess this qualification
- teaching staff will fully cover the knowledge, understanding and skills requirements in teaching and learning activities
- necessary resources are available for teaching staff and students during teaching and assessment activities, to give students every opportunity to meet the requirements of the qualification and reach the highest grade possible
- there's a system of standardisation in place so that all assessment decisions for teacher-marked (centre assessed) assignments are consistent, fair, valid and reliable (see internal standardisation in section 6.4.3)
- there's enough time for effective teaching and learning, assessment and internal standardisation
- processes are in place to make sure that students' work is individual and confirmed as being authentic (see Ways to authenticate work in section 6.2.1)
- you must use the OCR-set assignments for students' summative assessments You must make sure that students use the assignment that is live for the period during which they are taking their summative assessment.
- the OCR-set assignments must not be used for practice (see section 6.2, Requirements and guidance for delivering and marking the OCR-set assignments). This includes both assignments that are currently live or live assignments that have expired. Sample assessment material for each of the NEA units is available on Teach Cambridge and the OCR website. The sample assessment material can be used for practice purposes

1 This is the most senior officer in the organisation, directly responsible for the delivery of OCR qualifications, For example, the headteacher or principal of a school/college. The head of centre accepts full responsibility for the correct administration and conduct of OCR exams.

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- students understand what they need to do to get the highest marks possible
- students understand what it means when we say work must be authentic and individual and they (and you) must follow any requirements we set out to make sure their work is their own
- students know they must not reference another individual's personal details in any evidence produced for summative assessment in accordance with the General Data Protection Regulations (UK GDPR). It is the student's responsibility to make sure evidence that includes another individual's personal details is anonymised
- marks submitted to us are correct, accurately recorded and adhere to the published deadlines
- Assessment of set assignments must adhere to the JCQ Instructions for conducting non-examination assessments (Vocational and Technical Qualifications) and JCQ AI Use in Assessments: Protecting the Integrity of Qualifications.
- a declaration is made at the point you're submitting any work to us for assessment that confirms:
  - all assessment is conducted according to the specified regulations
  - students' work is authentic
  - marks have been transcribed accurately
- centre records and students' work are kept according to the requirements below:
  - students' work must be kept until after their unit has been awarded and any review of results or appeals processed. We will not consider any review if the work has not been kept
  - internal standardisation and assessment records must be kept securely for a minimum of three years after the date we've issued a certificate for a qualification
- All cases of suspected malpractice involving teachers or students must be reported (see 'Reporting suspected malpractice' in section 6.3.1).

6.2 Requirements and guidance for delivering and marking the OCR-set assignments

The assignments are set by us, taken under supervised conditions, marked by the teacher and moderated by us. Assignments are available on our secure website, Teach Cambridge.

The set assignments give an approximate time that it will take to complete all tasks. These timings are for guidance only, but should be used by you, the teacher, to give students an indication of how long to spend on each task. You can decide how the time should be allocated between each part or individual task. You are also permitted to spread the tasks across several sessions, and therefore it is permissible for evidence to be produced over several sessions.

We will replace the set assignments each year. New set assignments will be released on 1st June. You must:

- only download assignments from our secure website, Teach Cambridge and use the assignments for the assessment series shown on the front cover.
- have made entries for the series you are intending to submit the NEA work for.
- not share the set assignments with anyone from outside of your centre. These must only be shared with appropriate centre staff and students taking the assessments. (More information about maintaining the integrity of assessment materials is in the JCQ document General Regulations for Approved Centres General and Vocational qualifications.)
- make sure students know that they must not share assessment material or their own work with others, including posting or sharing on social media. (More information is in the JCQ guidance Information for candidates Using social media and examinations/ assessments.)

Assessment of the set assignments must adhere to the JCQ Instructions for conducting non-examination assessments (Vocational and Technical Qualifications).

Appendix A of this specification gives guidance for creating electronic evidence for the NEA units. Please read Appendix A along with the unit content and marking criteria grids as it might help you plan your delivery of the units.

The rest of this section deals with how we expect you to manage the delivery and marking of the set assignments, so that assessment is valid and reliable. Please note that failing to meet these requirements may be deemed to be malpractice.

Here is a summary of what we need you to do.

You **must**:

- have covered the knowledge, understanding and skills with your students and be sure they are ready for assessment before you start the summative assessment
- use the correct live OCR-set assignment for summative assessment (the dates for which set assignments are live are shown on the front cover). These assignments are only available on **Teach Cambridge.**
- give students the Student Guidance document before they start the assessment
- make sure students are clear about the tasks they must complete and the criteria they are expected to meet. You can:
    - explain the task
    - provide a copy of the marking criteria to students
- allow students a reasonable amount of time to complete the assignments and be fair and consistent to all students. The time you allow should be in line with the estimated time we think it should take which is stated in the OCR-set assignments. Within that time students can work on the tasks under teacher supervision any time until the date the centre collects the work for centre assessment
- tell the students the resources and sources of assets that they can use in the assignment before undertaking the assessment tasks
- only give students OCR-provided templates. If they opt to use a template from a book, a website or course notes when, for example, creating a plan for the production of a prototype, they must make sure the source is referenced
- monitor students' progress to make sure work is capable of being assessed against the marking criteria, on track for being completed in good time and is the **student's own** work:
    - NEA work **must** be completed during normal curriculum time and supervised and marked by the teacher/assessor
    - work must be carried out with enough supervision to make sure that the work submitted can be confidently authenticated as the student's own work. You must also be familiar with the requirements of the JCQ document AI Use in Assessments: Protecting the Integrity of Qualifications
    - if you provide any material to prepare students for the set assignment, you must adhere to the rules on using referencing and on acceptable levels of guidance to students set out within the Plagiarism and Feedback sections (see 6.2.2 Plagiarism and 6.3 Feedback)
    - students must produce their work independently (see 6.2.1 and 6.3 on Ways to authenticate work and Feedback)
    - you must make sure students are aware of the requirement to keep their work secure, not share with other students and keep their passwords secure
- allow students to take the initiative to improve any element of their work as they work through the assignment
- use the marking criteria to mark students' work

Before submitting a final mark to us, you can mark students' completed assignment work and allow them to repeat any element of the assignment, reworking their original evidence, provided the assignment is still live for use. We call this a reattempt. Students must have completed the whole assignment before you mark their work. Any feedback given to students on the marked work **must**:

- be factual: telling the student what you have observed, not what to do to improve their work.
- be recorded and available to the moderator section 6.3 Feedback

You **must not**:

- change any aspect of the OCR-set assignments (scenarios or tasks)
- accept multiple reattempts of work where small changes have been made in response to feedback. Marking and feedback must not be an iterative process
- allow teachers or students to add, amend or remove any work after students have submitted work for moderation. This will constitute malpractice
- give detailed advice and suggestions to individuals or the whole class on how work may be improved to meet the marking criteria
- practise the OCR-set assignment tasks with the students. We provide Sample Assignments for you to use for practice purposes
- create or use practice assignments and practice data which are similar in nature to those set by us
- use past OCR-set assignments, or amend past set assignments, for practice purposes.

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6.2.1 Ways to authenticate work

You must be confident that the work you mark is the student's own. Every student must produce their own work independently under teacher supervision. You must use enough supervision, or complete sufficient checks, to be able to judge the authenticity of the student's work.

Wherever possible, the teacher should discuss work-in-progress with students. This will make sure that work is being completed in a planned and timely way and provide opportunities for you to check authenticity of the work.

You must:

- have read and understood the JCQ document AI Use in Assessments: Protecting the Integrity of Qualifications
- make sure students and other teachers understand what constitutes plagiarism and not accept plagiarised work as evidence (you might find the JCQ document Plagiarism in Assessments helpful)
- use supervision and questioning as appropriate to confirm authenticity
- make sure students and teachers fill in authentication statements.

6.2.2 Plagiarism (including AI misuse)

When producing final 'written' pieces of work for the set assignments, students must use their own words to show they have genuinely applied their knowledge and understanding. When students use their own words, ideas and opinions, it reduces the possibility of their work being identified as plagiarised. Plagiarism is:

- the submission of someone else's work as your own
- failure to acknowledge a source correctly, including any use of written material, the internet or Artificial Intelligence (AI).

You might find the following JCQ documents helpful:

- Plagiarism in Assessments
- AI Use in Assessments: Protecting the Integrity of Qualifications

Plagiarism (including AI misuse) makes up a large percentage of cases of suspected malpractice reported to us by moderators. Teachers must ensure students understand they must not include plagiarised work as evidence.

Plagiarism (including AI misuse) often occurs innocently when students do not know that they must reference or acknowledge their sources or aren't sure how to do so. It's important to make sure your students understand:

- the meaning of plagiarism (including AI misuse) and what penalties may be applied
- that they can refer to research, quotations or evidence produced by somebody else but they must list and reference their sources and clearly mark quotations
- quoting someone else's work, even when it's properly sourced and referenced, doesn't evidence understanding. The student must 'do' something with that information to show they understand it. For example, if a student has to analyse data from an experiment, quoting data doesn't show that they understand what it means. The student must interpret the data and, by relating it to their assignment, say what they think it means. The work must clearly show how the student is using the material they have referenced **to inform their** thoughts, ideas or conclusions.

We have a Guide to referencing on our website. We have also produced a poster about referencing and plagiarism which may be useful to share with students.

You must teach your students:

- to always reference or acknowledge material copied from the internet or other sources. This applies to infographics (graphical information providing data or knowledge) as well
- how to reference and explain why it's important to do it. They must:
    - use quote marks to show the beginning and end of the copied work
    - for website text, to list the html address and ideally the date they accessed the website
    - show the name of any AI source used and the date the content was generated for computer-generated content (such as an AI Chatbot)
        - retain a copy of the question(s) and computer-generated content for reference, assessment and authentication purposes (see JCQ Guidance for full requirements)
    - for other publications, to list the name of the resource/book/printed article and ideally the year in which it was published.
- to identify information they have copied from teaching handouts and presentations for the unit, using quote marks and stating the text is from class handouts.

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Identifying copied/plagiarised work

Inconsistencies throughout a student's response are often indicators of plagiarism. For example:

- different tones of voice, sentence structure and formality across pieces of work
- use of American expressions, spellings and contexts (such as American laws and guidelines)
- dated expressions and references to past events as being current
- sections of text in a document where the font or format is inconsistent with other sections.

What to do if you think a student has plagiarised

If you identify plagiarised work at the point of marking or moderation:

- this **must** be taken into account when applying the mark scheme.
    - the work **must** be included with any work that is sent to the moderator if it is part of the moderation sample, with a note on the Unit Recording Sheet to state that there is plagiarism in the work and that marks have been adjusted accordingly
- the student(s) must be reported for plagiarism in line with the JCQ document Suspected Malpractice Policies and Procedures
    - Fill in the JCQ form M1

In line with the policy and procedures of JCQ on suspected malpractice, the sanctions applied for plagiarism (including AI misuse) could result in a warning, loss of marks or loss of aggregation or certification opportunity.

6.3 Feedback

Feedback to students on work in progress towards summative assessment

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

Generic guidance to the whole class is also allowed. This could include reminding students to check they have provided evidence to cover every aspect of the task. Individual students can be prompted to double check for gaps in evidence providing that specific gaps are not pointed out to them.

You can give general feedback and support if one or more students are struggling to get started on an aspect of the assignment or following a break between sessions working on the assignment. For example, if a student is seeking more guidance that suggests they are not able to apply knowledge, skills and understanding to complete their evidence you can remind them that they had a lesson which covered the relevant topic. The student would then need to review their own notes to find this information and apply it as needed.

Feedback must not provide specific advice and guidance that would be construed as coaching. This would compromise the student's ability to independently perform the task(s) they are doing and constitutes malpractice. Our moderators use a number of measures to assure themselves the work is the student's own.

If an individual student needs additional help or support because they are struggling to start a task or part of a task that is **critical to them accessing the rest of the task or assignment,** this **must** be recorded on the student's work and/or Unit Recording Sheet (URS) for our Moderator to see. In this situation, the student should **not** be awarded the marks for the work for which they received help.

Assessing completed work

When students have completed all their work on an assignment, you must assess it (mark it) and give feedback to them. Assessment should not be an iterative process. This means you must not assess work and give feedback on it in stages. You must only assess the work when the assignment is complete.

Feedback **must**:

- be supportive, encouraging and positive
- tell the student what has been noticed, not what the you think (for example if you have observed the student completing a task you can describe what happened, what was produced and what was demonstrated)

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Feedback **can**:

- identify what task and part of the task could be improved, but not detail how to improve it. You could show the student work from a **different** unit that demonstrates higher achievement, but you must not detail to the student how they could achieve that in their work. If you are using another student's work as a model answer, please anonymise this work. You could remind students that they had a lesson on a specific topic and that they could review their notes, but you must not tell them how they could apply the teaching to improve their work.
- comment on what has been achieved, for example 'the evidence shows an **adequate** understanding for MB2'
- identify that the student hasn't met a descriptor word or mark band requirement. For example, 'This is a description, not an evaluation'
- use text from the specification, assignment or marking criteria in general guidance to clarify what is needed in the work. For example 'you need to consider all points relating to the creation of standard operating procedures. You have included **all** the information required to manufacture the product in your standard operating procedures, but only identified **some** of the operations required, and the sequence of operations may need minor adjustment to be a workable sequence'
- point out where the work sits within the mark bands but students must make their own decisions as to what to improve and how. For example, the feedback can say 'this shows a **sound** understanding' (for mark band 2) but not precisely what should be added to make it show a **comprehensive** understanding (for mark band 3).

Feedback **must not**:

- point out specific gaps, for example you must not prompt the student to include specific detail in their work, such as 'You need to improve this by giving more detail'
- be so detailed that it
  - leads students to the answer, for example you must not give model answers on the **same** unit being taken or explain specifically what amendments should be made. If work from another student on a **different unit** is being used to model answers, please ensure it is anonymised.
  - provides a step-by-step guide on what to do to complete or improve work, for example you must not give headings or templates that include examples which give all or part of what students have to write about or produce.
- talk the student through how to achieve or complete the task.
- give detail on where to find information/evidence.

In other words, feedback must help the student to take the initiative in making changes. It must not direct or tell the student what to do to complete or improve their work in a way that means they do not need to think how to apply their learning. Students need to recall or apply their learning. You must not do the work for the student(s).

Neither you nor the student can add, amend or remove any work after the final mark has been submitted for moderation.

Please see additional guidance for students who wish to resubmit their work following OCR moderation in Section 6.7.

Informing students of their marks

When you have marked students' work, you must inform students of the marks achieved. **Before** you submit marks to us, you must provide enough time for:

- students to appeal the marks.
- you to complete a review and make changes if needed.
- you to inform students of the outcome of the review.

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What improper assistance might look like

When we see anything that suggests the teacher has led students to the answer, we become concerned because it suggests students have not worked independently to produce their assignment work. The following are examples of what may indicate improper assistance by the teacher:

- prompts that instruct students to include specific detail in their work, such as, 'You need to define the difference between sketching techniques. How are they used? Which techniques are most appropriate?'
- headings or templates that include examples which give all or part of what students have to write about or produce, such as planning the manufacture of a prototype.

Moderators will report suspected malpractice when they cannot see differences in content between students' work in the sample they are moderating. An exception is when students have only used and referenced technical facts and definitions. If the moderator is in any doubt, they will report suspected malpractice. The decision on whether or not to investigate is made by us not the moderator.

6.3.1 Reporting suspected malpractice

It is the responsibility of the head of centre to report all cases of suspected malpractice involving teachers or students.

A JCQ Report of Suspected Malpractice form (JCQ/M1 for student suspected malpractice or JCQ/M2 for staff suspected malpractice) is available to download from the JCQ website and must be completed as soon as possible and emailed to us at compliance@ocr.org.uk.

When we ask centres to investigate instances of malpractice, heads of centres must act promptly and report the outcomes to us.

More information about reporting and investigating suspected malpractice, and the possible sanctions and penalties which could be imposed, is in the JCQ publication: Suspected Malpractice Policies and Procedures. You can also find out more on our website.

6.3.2 Supervision

NEA work must be completed in normal curriculum time and supervised and marked by the teacher. You must use enough checks so you're confident the student's work is authentic.

For example, you can use questioning to confirm the depth and breadth of their understanding of the topic they've covered in a specific piece of work.

6.3.3 Candidate and teacher authentication

Both students and teachers must declare that the work is the student's own:

- **Each student** must sign an authentication form before submitting their work to you. By signing the form, they declare the work is their own and any assistance given and/or sources used have been acknowledged.

  It is your responsibility to make sure every student does this.
- **Teachers must** also sign the authentication form for each student to declare the work submitted is the student's own.

You must retain authentication forms in your centre until all reviews of results, malpractice investigations and appeals have been resolved.

- The authentication form is on Teach Cambridge and OCR website.

6.3.4 Group working

We do not assess the skills associated with group work in this qualification and the OCR-set assignment will not include it. If it is necessary to use group work to make the delivery of the assignment more manageable, you must make sure that all practical tasks and evidence submitted for assessment that shows the student has met the marking criteria is entirely the individual's own work.

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6.3.5 Methods of assessment

It is your responsibility to choose the best method of assessing a student in relation to their individual circumstances. The methods chosen must be:

- valid
- reliable
- safe and manageable
- suitable to the needs of the student.

Valid

Validity can be compromised if a student does not understand what is being asked of them. For example, one valid method of assessing a student's knowledge and understanding is to question them. If the questions posed are difficult for the student to understand (not in terms of the content but the way they are phrased, for example) the validity of the assessment method is questionable.

As well as assessment methods being valid, the evidence presented must also be valid. For example, it would not be appropriate to present an organisation's equal opportunities policy as evidence towards a student's understanding of how the equal opportunities policy operates within the organisation. It would be more appropriate for the student to incorporate the policy within a report describing different approaches to equal opportunities.

Reliable

A reliable method of assessment will produce consistent assessment results for different teachers assessing on each occasion. Internal moderators must make sure that all teachers' assessment decisions are consistent.

Safe and manageable

You must make sure that the assessment methods and approaches taken:

- are safe and manageable
- do not put unnecessary demands on the student
- are appropriate and in line with ethical standards and your centre's safeguarding responsibilities.

Suitable to the needs of the student

We are committed to ensuring that achievement of these qualifications is free from unnecessary barriers. You must follow this commitment through when amending tasks and/or considering assessment. If you are amending tasks and are not sure what is acceptable, contact us.

Observation and questioning

You and the student should plan observations together, but it is your responsibility to record the observation properly (for example observing a student undertaking a practical task). Find more information in the Teacher Observation Records section below:

- **observation** of a student doing something
- **questioning** of the student or witness.

Observation

You and the student should plan the observations together but it is your responsibility to record the observation properly (for example observing a student undertaking a practical task). Find more information in the Teacher Observation Records section below.

Questioning

Questioning the student is normally an ongoing part of the formative assessment process and may, in some circumstances, provide evidence to support achievement of the criteria.

Questioning is often used to:

- test a student's understanding of work which has been completed outside of the classroom (where this may be permitted)
- check if a student understands the work they have completed
- collect information on the type and purpose of the processes a student has gone through.

If questioning is to be used as evidence towards achievement of specific topic areas, it is important that you record enough information about what you asked and how the student replied, to allow the assessment decision to be moderated.

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6.3.6 Teacher Observation Records

It is a requirement that a teacher completes the Teacher Observation Record form, located on our secure website, Teach Cambridge, for **the following OCR set-assignments Unit R015 and R016** for each student as evidence of their machining and setting up and operating CNC equipment. The Teacher Observation Record form should support evidence of a student using tools and equipment and a manually controlled machining process (R015), and the setting up and use of CNC equipment to manufacture parts (R016), alongside evidence such as annotated photographic evidence.

Teacher observation **cannot** be used as evidence of achievement for a whole unit. Most evidence should be produced directly by the student. Teacher observation should only be used where specified as an evidence requirement (For example, for using tools and equipment and machining in R015 and the setting up and operating of CNC equipment in R016.).

Teacher Observation Records must be individual to each student and suitably detailed, to help moderators determine if the grading criteria have been met. You must follow the guidance provided in the 'guidance notes' section of the form so that the evidence captured and submitted is appropriate. Both the student and the teacher must sign and date the form to show that you agree its contents. Electronic signatures are acceptable. The signed form must form part of the students' evidence and be submitted with work requested for moderation.

Where the guidance has not been followed, the reliability of the form as evidence may be called into question. If doubt about the validity of the Teacher Observation Record form exists, it cannot be used as assessment evidence and marks based on it cannot be awarded. Moderators will be instructed to adjust centre marks accordingly.

6.3.7 Presentation of the final piece of work

Students must observe the following procedures when producing their final piece of work for the NEA tasks:

- work can be word processed or hand-written
- tables and graphs (if relevant) may be produced using appropriate ICT
- any copied material must be suitably acknowledged
- quotations must be clearly marked and a reference provided
- a completed Unit Recording Sheet must be attached to work submitted for moderation. The Unit Recording Sheet can be downloaded from Teach Cambridge
- Centres **must** provide guidance on the Unit Recording Sheet (URS) to show where specific evidence can be found. This may be through the use of the 'page number' column and/or by referencing file names and locations
- Work submitted digitally for moderation should be on electronic media (for example, on our portal, CD or USB Drive), and be in a suitable file format and structure, as detailed in Appendix A at the end of this specification. Students must submit their completed product(s) in an electronic format that is suitable for the client in the set assignment.

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6.4 Marking NEA units

All NEA units are internally marked by teachers using the OCR marking criteria and guidance. This could be the teacher who has delivered the programme or another person from the centre. The work is then externally moderated by our moderators. Assessment of the set assignments must adhere to the JCQ Instructions for conducting non-examination assessments (Vocational and Technical Qualifications).

The marking criteria must be used to mark each student's work. These specify the levels of skills, knowledge and understanding that the student is required to demonstrate.

6.4.1 Use of a 'best fit' approach to marking criteria

The assessment tasks should be marked by teachers/assessors according to the OCR marking criteria using a 'best fit' approach. For each of the marking criteria, teachers/assessors select the band descriptor provided in the marking grid that most closely describes the quality of the work being marked.

Marking should be positive, rewarding achievement rather than penalising failure or omissions. The award of marks **must be** directly related to the marking criteria.

- Each band descriptor covers all the relevant content for the topic areas.
- The descriptors should be read and applied as a whole.
- Make a best fit match between the answer and the band descriptors.
- An answer does not have to meet all of the requirements of a band descriptor before being placed in that band. It will be placed in a particular band when it meets more of the requirements of that band than it meets the requirements of other bands.
- Where there is more than one strand within the band descriptors for a topic area and a strand has not been addressed at all, it is still possible for the answer to be credited within that mark band depending upon the evidence provided for the remaining strands. The answer should be placed in the mark band most closely reflecting the standard achieved across all strands within the band descriptors for topic areas; however in this scenario, the mark awarded for that band should reflect that a strand has not been addressed.

When deciding the mark within a band, the criteria below should be applied:

- the extent to which the statements within the band have been achieved. For example:
    - an answer that convincingly meets nearly all of the requirements of a band descriptor should be placed at or near the top of that band. Where the student's work convincingly meets the statements, the highest mark should be awarded
    - an answer that meets many of the requirements of the band descriptor should be placed in the middle of the band. Where the student's work adequately meets the statements, the most appropriate mark in the middle range should be awarded
    - if an answer is on the borderline between two bands but it is decided that it better fits the descriptors for:
        - the lower of these two bands - it should be placed near the top of the lower band
        - the higher of these two bands - the lowest mark for the higher band should be awarded.
- if a student's work does not meet any Mark Band 1 (MB1) criteria for the task, you must award zero marks for that task.

Teachers/assessors should use the full range of marks available to them and award full marks in any band for work that fully meets that descriptor. This is work that is 'the best one could expect from students working at that level'.

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6.4.2 Annotating students' work

Each piece of NEA work should show how the marks have been awarded in relation to the marking criteria.

Writing comments on students' work and Unit Recording Sheet (URS) provides a means of communication between teachers during the internal standardisation, and with the moderator if the work is part of the moderation sample. You should include the set assignment's title on each Unit Recording Sheet (URS) in the scenario title field to help easily identify the assignment taken.

If you have given additional, more specific support or guidance to an individual student to get them started on a task, because they could not start a task or part of a task that was **critical to them accessing the rest of the task or assignment**, this must be recorded on the student's work and/or Unit Recording Sheet (URS) for our Moderator to see (see Section 6.3). In this situation, the student should **not** be awarded the marks for the work for which they received help, and the marks achieved must be adjusted appropriately. Recording this on the student's work and/or URS will help our Moderator to understand why the marks have not been awarded.

6.4.3 Internal standardisation

It is important that all teachers/assessors work to common standards. Centres must make sure that, within each unit, the internal standardisation of marks across teachers/assessors and teaching groups takes place using an appropriate procedure.

This can be done in a number of ways. In the first year, reference material and OCR training meetings will provide a basis for centres' own standardisation. In following years, this, or centres' own archive material, may be used. We advise centres to hold preliminary meetings of staff involved to compare standards through cross-marking a small sample of work. After most marking has been completed, a further meeting at which work is exchanged and discussed will help final adjustments to be made.

If you're the only assessor in your centre for this qualification, then it's still advisable to make sure your assessment decisions are internally standardised by someone else in your centre, ideally someone who has experience of the nature of this qualification (For example, is delivering a similar qualification in another subject) or relevant subject knowledge and asking them to review a sample of the assessments.

You must keep evidence of internal standardisation in the centre for the moderator to see.

We have a guide to how internal standardisation may be approached on our website.

6.4.4 Reattempting work before submitting marks to OCR

As described in Section 6.2, before submitting a final mark to us, you can allow students to repeat any element of the assignment and rework their original evidence – we refer to this as a '**reattempt**'. This is to allow the student to reflect on the feedback, which must be recorded, and improve their work. It is not an iterative process where they make small modifications through ongoing marking and feedback to eventually achieve the desired grade.

6.4.5 Submitting marks

All work for NEA units is marked by the teacher and internally standardised by the centre. Marks are then submitted to us. You can find the key dates on our website.

There should be clear evidence that work has been attempted and some work produced. If a student submits no work for a NEA unit, the student should be identified as being absent from that unit.

If a student completes any work at all for a NEA unit, then the work should be assessed according to the marking criteria and the appropriate mark awarded. This may be zero.

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6.5 Moderating NEA units

The purpose of external moderation is to make sure that the standard of marking is the same for each centre and that internal standardisation has taken place.

The administration pages of our website provide full details about how to submit work for moderation.

This includes the deadline dates for entries and submission of marks. For moderation to happen, centres must submit their marks.

6.5.1 Sample requests

Once you have submitted your marks, we will tell you which work will be sampled as part of the moderation. Samples will include work from across the range of attainment of students' work. Work for moderated units can be uploaded to us using our Submit for Assessment service or sent by post.

Copies of students' work must be kept until after their units have been awarded and any review of results or appeals processed.

As it is essential for us to have sample work available at awarding meetings, we may ask some centres to release work for awarding and archive purposes. We will let you know as early as possible if we need this from you and always appreciate your co-operation.

6.5.2 Outcome of moderation

Centres will receive the final outcomes of moderation when the provisional results are issued. Results reports will be available for you to access. More information about the reports that are available is on our administration pages.

6.6 Resubmitting moderated work to us to improve the grade

We use the term '**resubmission**' when referring to student work that has previously been submitted to us for moderation. Following moderation, if you and the student feel they have not performed at their best during the assessment, the student can, with your agreement, improve their work and resubmit it to you again for assessment. You must be sure it is in the student's best interests to resubmit the work for assessment.

There is one resubmission opportunity per NEA assignment. Students can only resubmit work using the same assignment if the assignment is still live. The series for which the assignment is live will be shown on the front cover of the assignment. We will not accept resubmitted work based on an assignment that is no longer live.

If students wish to resubmit a unit after the live assessment date has passed, they must submit work using the new live assignment for the unit for the resubmission.

If students are resubmitting in a different academic year, they can use the evidence they produced for the previous year's assignment, but they will need to make any changes that are necessary so that the work meets the requirements of the new scenario and task. (In some cases, using work from a previous year's assignment could mean using it and only making minor changes because the evidence still meets the requirements of the new assignment.)

Students can also build on the work to improve it. All work for a resubmission must be completed under the required teacher supervised conditions and marked against the marking criteria. You must not over direct students on how to adapt/improve work to meet the requirements of the new assignment. You must adhere to all requirements relating to giving and recording feedback from sections 6.3 and 6.7.

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6.7 Recording feedback and decisions

For reattempts and resubmissions, you must record the reasons why a student has been allowed to reattempt or resubmit in your centre's assessment decisions records. You must also follow our guidelines on giving feedback and record the feedback given to the student. All feedback given to the student for the purpose of a reattempt or resubmitting work must be recorded. We have created a set assignment feedback form, available on Teach Cambridge, which you can use to help support this. We monitor the assessment decisions you make. You must follow the guidelines outlined in Section 6.

We reserve the right to request the written feedback and the work in its original state. If you do not meet the requirements this will be treated as malpractice.

Neither you nor the student can add, amend or remove any work after the final mark has been submitted for moderation.

See Section 7.3 for terminal assessment rules.

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7 Administration

The information in this section gives an overview of the processes involved in administering this qualification. All of the following processes require you to submit something to OCR by a specific deadline. More information about the processes and deadlines involved at each stage of the assessment cycle can be found in the Administration area of the OCR website.

7.1 Assessment availability

There are two assessment series available each year in January and June to all students. Students can be entered for different units in different assessment series.

All students must take the exam at a set time on the same day in a series. Certification (where students achieve the qualification) is available each January and June.

Series	Unit availability	
	Unit R014	Units R015 and R016
January	✓	✓
June	✓	✓

- First assessment for externally assessed unit R014 is January 2024.
- First assessment for NEA units R015 and R016 is January 2023.
- Certification is available from January 2024.

7.2 Collecting evidence of student performance to ensure resilience in the qualifications system

Regulators have published guidance on collecting evidence of student performance as part of long-term contingency arrangements to improve the resilience of the qualifications system. You should review and consider this guidance when delivering this qualification to students at your centre.

For more detailed information on collecting evidence of student performance please visit our website.

7.3 Entry rules, including Terminal Assessment

Terminal assessment rule

The externally assessed unit must be taken as terminal assessment. This means the exam for unit R014 must be taken in the student's final assessment series which could be in January or June. This exam contributes 40% of the total marks available for the qualification.

NEA units can be submitted in any series but must be submitted either before or in the same series as the externally assessed unit.

Certification entries

- For a student to achieve the qualification, you need to make a qualification certification entry (aggregation) for the student's final series
- To be eligible to receive a result, the student must have been entered for both NEA units and met the terminal assessment rule
- You can make certification entries for the final series:
  - via Interchange or EDI at the same time as unit entries for the exam
  - by submitting a post-results late certification request via Interchange before the post-results late certification deadline for the series, which is after you have received exam results for that series
- As a contingency arrangement, if you miss the post-results late certification deadline, you can make a certification entry in a future series, provided:

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- no further assessment has taken place since the terminal rule was met, and
- you are making a certification entry only for the qualification in that future series (meaning you are not resitting or resubmitting a unit in the same series).

- You can make certification entries in the January or June series – this is the series that will appear on the qualification certificate
- Certification entries and late certification requests are always free of charge.

Post-result late certification

- Post-results late certification requests must be submitted via Interchange by the post-results deadline for the series. The deadline for each series can be found in the key dates document in the Administration area of our website
- **Note: Once the student has sat the exam in the June series, it is not possible to make a late certification request for the January series, as the final assessment series is now June.**

Resitting units before certification

- Students can take the exam before all the NEA units are completed. This is classed as a 'practice attempt'
  - 'Practice attempts' do not count towards the student's overall grade or in performance tables. The student will be issued with a unit result only
  - When the student has completed all the NEA units, if you do not make a certification entry when you enter for the exam, the exam will be classed as a practice attempt unless you make a late certification entry or a certification entry in a subsequent series
  - If a student takes the exam again after a practice attempt, the result of the latest attempt will count towards the qualification result, even if the practice attempt result was higher
- Work for each NEA assignment can be re-submitted once before the overall qualification is awarded. Students can only resubmit work using the same assignment if the assignment is still live. We will use the best result of both attempts towards the qualification result.
- If a student takes an NEA unit multiple times using different assignments for that unit, the best result of all attempts will be used to calculate the qualification result as long as they meet the terminal assessment rule.

Retaking the qualification

- After a student has achieved a qualification result, they can resit the externally assessed unit and submit the NEA units again in a later series to improve their qualification result:
  - students can resit the exam without resubmitting the NEA units
  - students cannot resubmit the NEA units only to improve results. In order to meet terminal assessment requirements, they must also resit the exam if they are resubmitting NEA units.
- Students can only resubmit work using the **same** assignment if the assignment is still live. The live assessment dates will be shown on the front cover of the assignment. We will not accept work based on an assignment that is no longer live. If students wish to resit a unit after the live assessment date has passed, they must submit work using the new live assignment.
- The result from the first overall qualification result is used towards the performance tables.

Please refer to the Administration pages of the OCR website (Administration - OCR) for more information on early entry and discounting.

7.4 Equality Act information relating to Cambridge Nationals

The Cambridge Nationals require assessment of a broad range of skills and, as such, prepare students for further study and higher-level courses.

The Cambridge Nationals qualifications were reviewed to check if any of the competences required presented a potential barrier to disabled students. If this was the case, the situation was reviewed again to make sure that such competences were included only where essential to the subject.

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7.5 Accessibility

There can be adjustments to standard assessment arrangements on the basis of the individual needs of students. It's important that you identify as early as possible whether students have disabilities or particular difficulties that will put them at a disadvantage in the assessment situation and choose a qualification or adjustment that allows them to demonstrate attainment.

If a student requires access arrangements in assessments that need approval from us, this must be gained in Access Arrangements Online. You must select Cambridge Nationals at time of application; approval from GCSE or A Level applications do not extend to Cambridge Nationals. However, more than one qualification type can be selected when making an application. For guidance or support please contact the Special Requirements Team.

The responsibility for providing adjustments to assessment is shared between your centre and us. Please read the JCQ booklet Access Arrangements and Reasonable Adjustments.

If you have students who need a post-examination adjustment to reflect temporary illness, indisposition or injury when they took the assessment, please read the JCQ document A guide to the special consideration process.

If you think any aspect of this qualification unfairly restricts access and progression, please email or call our Customer Support Centre.

The access arrangements permissible for use in this specification are as follows:

Access arrangement	Yes/No	Type of assessment
Reader/Computer reader	Yes	All assessments
Scribes/Speech recognition technology	Yes	All assessments
Practical assistants	Yes	All assessments
Word processors	Yes	All assessments
Communication professional	Yes	All assessments
Language modifier	Yes	All assessments
Modified question paper	Yes	Timetabled examinations
Extra time	Yes	All assessments with time limits

7.6 Requirements for making an entry

We provide information on key dates, timetables and how to submit marks on our website.

Centres must be registered with OCR in order to make any entries. We recommend that centres apply to become a registered centre with us, well in advance of making their first entries. Details on how to register with OCR can be found on our website.

7.6.1 Making estimated unit entries

Estimated entries are not required for Cambridge Nationals in Engineering Manufacture.

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7.6.2 Making final unit entries

When making an entry, centres will need the unit entry codes and component codes. Students submitting work must be entered for the appropriate unit entry code from the table below.

The same component code must be used for all students entered for a unit in the same session. Work for moderated units can be uploaded to us using our Submit for Assessment service or sent by post.

The short title for these Cambridge National qualifications is CAMNAT and will display as such on our secure website 'Interchange' and some of our administrative documents.

You do not need to register your students first. Individual unit entries should be made for the series in which you intend to submit or resubmit an NEA unit or sit the externally assessed examination.

Only make a certification entry using the overall qualification code (see section 7.7) in the final series.

Unit entry code	Component code	Assessment method	Unit titles
R014	01	Written paper	Principles of engineering manufacture
R015	01	Moderated – Upload	Manufacturing a one-off product
R015	02	Moderated – Postal	Manufacturing a one-off product
R016	01	Moderated – Upload	Manufacturing in quantity
R016	02	Moderated – Postal	Manufacturing in quantity

7.7 Certification rules

Students must be entered for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded. Students must be entered for:

- OCR Level 1/Level 2 Cambridge National in Engineering Manufacture - certification code J823.

7.8 Unit and qualification resits

Students may resit the externally assessed unit R014**. Please see** section 7.3 **for information relating to our terminal assessment approach.**

Students may resit each NEA assignment once. The best unit result from the NEA units will be used to calculate the certification result.

You must make sure that when arranging resit opportunities they are fair to all students and do not give students an unfair advantage over other students. For example, the student must not have direct guidance and support from the teacher in producing further evidence for NEA units. When resitting a NEA unit, students must submit new, amended or enhanced work, as detailed in the JCQ Instructions for conducting non-examination assessments (Vocational and Technical Qualifications).

Centres must make sure that when arranging resit opportunities they do not adversely affect other assessments being taken.

Arranging a resit opportunity is at the centre's discretion. Summative assessment series must not be used as a diagnostic tool and resits should only be planned if it is clear that the student has taken full advantage of the first assessment opportunity and formative assessment process.

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7.9 Post-results services

A number of post-results services are available:

- Reviews of results – If you think there might be something wrong with a student's results, you may submit a review of marking or moderation
- Missing and incomplete results – This service should be used if an individual subject result for a student is missing, or the student has been omitted entirely from the results supplied
- Access to scripts – our free service for exams officers to download copies of students' completed question papers
- Late certification – following the release of unit results, if you have not previously made a certification entry, you can make a late request, which is known as a **late certification**. This is a free service.

Please refer to the JCQ Post-Results Services booklet and the OCR Administration page for further guidance about action on the release of results.

For internally assessed units the review of results process cannot be carried out for one individual student; the outcome of a review of moderation must apply to a centre's entire cohort.

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Appendix A: Guidance for the production of electronic evidence

Structure for evidence

The centre-assessed (NEA) units in this qualification are units R015 and R016. For each student, all the tasks together will form a portfolio of evidence, stored electronically. Evidence for each unit must be stored separately.

An internal assessment portfolio is a collection of folders and files containing the student's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or moderator. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index called 'Home Page'.

There should be a top-level folder detailing the student's centre number, OCR candidate number, surname and forename, together with the unit code (R015 and R016), so that the portfolio is clearly identified as the work of one student.

Each student's internal assessment portfolio should be stored in a secure area on the centre's network. Before submitting the portfolio to OCR, the centre should add a folder to the folder tree containing the internal assessment and summary forms.

Data formats for evidence

In order to minimise software and hardware compatibility issues it will be necessary to save students' work using an appropriate file format.

Students must use formats appropriate to the evidence that they are providing and appropriate to viewing for assessment and moderation. Open file formats or proprietary formats for which a downloadable reader or player is available are acceptable. **Where this is not available, the file format is not acceptable.**

Evidence submitted is likely to be in the form of word processed documents, presentation documents, digital photos and digital video.

To make sure files are compatible, all files submitted electronically must be in the formats listed below. Where new formats become available that might be acceptable, we will provide further guidance. We advise against changing the file format that the document was originally created in. Files should be exported in a generic format that can be opened on a PC computer system without any specialist software applications. It is the centre's responsibility to make sure that the electronic portfolios submitted for moderation are accessible to the moderator and fully represent the evidence available for each student.

Standard file formats acceptable as evidence for the Cambridge Nationals are listed here.

File type	File format	Max file size*
Audio	.3g2 .3ga .aac .aiff .amr .m4a .m4b .m4p .mp3 .wav	25GB
Compression	.zip .zipx .rar .tar .tar .gz .tgz .7z .zipx .zz	25GB
Data	.xls .xlsx .mdb .accdb .xlsb	25GB
Document	.odt .pdf .rtf .txt .doc .docx .dotx	25GB
Image	.jpg .png .jpeg .tif .jfif .gif .heic .psd .dox .pcx .bmp .wmf	25GB
Presentation	.ppt .pptx .pdf .gslides .pptm .odp .ink .potx .pub	25GB
Video	.3g2 .3gp .avi .flv .m4v .mkv .mov .mp4 .mp4v .wmp .wmv	25GB
Web	.wlmp .mts .mov-1 .mp4-1 .xspf .mod .mpg	25GB

If you are using **.pages** as a file type, please convert this to a pdf prior to submission.

*max file size is only applicable if using our Submit for Assessment service.

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Submit for Assessment is our secure web-based submission service. You can access Submit for Assessment on any laptop or desktop computer running Windows or macOS and a compatible browser. It supports the upload of files in the formats listed in the table above as long as they do not exceed the maximum file size. Other file formats and folder structures can be uploaded within a compressed file format.

When you view some types of files in our Submit for Assessment service, they will be streamed in your browser. It would help your moderator or examiner if you could upload files in the format shown in the table below:

File type	File format	Chrome	Firefox
Audio	.mp3	Yes	Yes
Audio	.m4a	Yes	Yes
Audio	.aac	No	Yes
Document	.txt	Yes	Yes
Image	.png	Yes	Yes
Image	.jpg	Yes	Yes
Image	.jpeg	Yes	Yes
Image	.gif	Yes	Yes
Presentation	.pdf	Yes	Yes
Video	.mp4	Yes	Yes
Video	.mov	No	Yes
Video	.3gp	Yes	No
Video	.m4v	Yes	Yes
Web	.html	Yes	Yes
Web	.htm	Yes	Yes

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Appendix B: Command and descriptor words

External assessment

The table below shows the command words that will be used in exam questions. They show what we mean by the command word and how students should approach the question and understand its demand. Remember that the rest of the wording in the question is also important.

Word(s)	Students will....
Analyse	• Separate or break down information into parts and identify their characteristics or elements • Explain the pros and cons of a topic or argument and make reasoned comments • Explain the impacts of actions using a logical chain of reasoning
Annotate	• Add information, for example, to a table, diagram or graph until it is final • Add all the needed or appropriate parts
Calculate	• Get a numerical answer showing how it has been worked out
Choose	• Select an answer from options given
Circle	• Select an answer from options given
Compare and contrast	• Give an account of the similarities and differences between two or more items or situations
Complete	• Add all the needed or appropriate parts • Add information, for example, to a table, diagram or graph until it is final
Create	• Produce a visual solution to a problem (for example: a mind map, flowchart or visualisation)
Describe	• Give an account including all the relevant characteristics, qualities or events • Give a detailed account of
Discuss	• Present, analyse and evaluate relevant points (for example, for/against an argument)
Draw	• Produce a picture or diagram
Evaluate	• Make a reasoned qualitative judgement considering different factors and using available knowledge/experience
Explain	• Give reasons for and/or causes of • Use the words or phrases such as 'because', 'therefore' or 'this means that' in answers.
Fill in	• Add all the needed or appropriate parts • Add information, for example, to a table, diagram or graph until it is final
Identify	• Select an answer from options given • Recognise, name or provide factors or features
Justify	• Give good reasons for offering an opinion or reaching a conclusion
Label	• Add information, for example, to a table, diagram or graph until it is final • Add all the necessary or appropriate parts
Outline	• Give a short account, summary or description
State	• Give factors or features • Give short, factual answers

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Non examined assessment (NEA)

The tables below show the descriptor words that will be used in the NEA Marking Criteria grids. They explain the type of evidence that you should expect to see to meet each descriptor word.

Mark Band (MB1) Words:

Descriptor word	Meaning
Basic	• Work includes the minimum required. It is a starting point but is simplistic and not developed. • Understanding and skills are applied in a way that partly achieves the wanted or intended result, but it would not be useable without further input or work.
Brief/Briefly	• Work includes a small number of relevant facts or concepts but lacks detail, contextualisation or examples.
Dependent	• The student can perform a task when given regular assistance or help
Few	• Work produced is restricted or narrow. It includes less than half of the information or examples expected for a full response.
Inefficient	• Outputs are produced but with great expense or effort because of poor organisation or design and not making the best use of available resources.
Limited	• Work produced is restricted in range or scope and includes only some of the information required. It evidences partial rather than full understanding. • Work produced is a starting point rather than a developed process, concept or output.
Minimal	• Includes very little in amount or quantity required.
Simple	• Includes a small number of relevant parts, which are not related to each other.
Superficial	• Work completed lacks depth and detail.

Mark Band (MB2) Words:

Descriptor word	Meaning
Adequate(ly)	• Work includes the appropriate number of relevant facts or concepts but does not include the full detail, contextualisation or examples.
Assisted	• The student can perform a task with occasional assistance or help.
Part(ly)/Partial	• To some extent but not completely. • Work produced is inclusive in range and scope. It evidences a mainly developed application of understanding, performance or output needed. • Work produced results in a process, concept or output that would be useable for its purpose.
Some	• Work produced is inclusive but not fully comprehensive. It includes over half the information or examples expected for a full response.
Sound	• Valid, logical, shows the student has secured most of the relevant understanding, but points or performance are not fully developed. • Applies understanding and skills to produce the wanted or intended result in a way that would be useable.

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Mark Band (MB3) Words:

Descriptor word	Meaning
Accurate(ly)	• Acting or performing with care and precision. • Correct in all details.
All	• Work produced is fully comprehensive and wide-ranging. It includes almost all, or all the information or examples expected for a full response.
Clear(ly)	• Focused and accurately expressed, without ambiguity.
Complex	• Includes many relevant parts, all of which relate to each other logically.
Comprehensive(ly)	• The work produced is complete and includes everything required to show depth and breadth of understanding. • Applies the understanding and skills needed to successfully produce the wanted or intended result in a way that would be fully fit-for-purpose.
Consistent(ly)	• A level of performance which does not vary in quality over time.
Critical	• Objective analysis and evaluation in order to form: a judgement, evaluation of the evidence or effective trouble shooting/fault finding.
Detailed	• Gives point by point consideration of all the key information.
Effective	• Applies the skills required to the task and is successful in producing the desired or intended result. • The work produced is effective in relation to a brief.
Efficient	• Able to produce results or outputs with the minimum expense or effort, because of good organisation or design and making the best use of available resources.
Full(y)	• Work produced is comprehensive in range and scope. It evidences a fully developed application of understanding, performance or output needed. • Work produced results in a process, concept or output that would be fully fit-for-purpose.
Independent(ly)	• The student can perform a task without assistance or reliance on others
Justify/Justified	• The reasons for doing something are explained in full.
Most(ly)	• Includes nearly all of what is expected to be included.
Wide (ranging)	• Includes many relevant details, examples or contexts; all of which are fully detailed, contextualised or exemplified.

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01223 553998
support@ocr.org.uk
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