

LEVEL 1/2 VOCATIONAL AWARD IN ENGINEERING (TECHNICAL AWARD)

GUIDANCE FOR TEACHING

UNIT 2 GUIDE

VERSION 3 – FEBRUARY 2024

SUMMARY OF AMENDMENTS

Version	Description	Page number
3	Clarification of the release date and submission date of the controlled assessment.	17

AIMS OF THE GUIDANCE FOR TEACHING

The principal aim of the Guidance for Teaching is to support teachers in the delivery of the WJEC Level 1/2 Vocational Qualification in Engineering (Technical Award) and to offer guidance on the requirements of the qualification and the assessment process. The Guidance for Teaching is **not intended as a comprehensive reference**, but as support for professional teachers to develop stimulating and exciting courses tailored to the needs and skills of their own learners in their particular institutions.

AIMS OF THE UNIT GUIDE

The principal aim of the Unit Guide is to support teaching and learning and act as a companion to the Specification. Each Unit Guide will offer detailed explanation of key points in the Specification and aim to explain complex areas of subject content. An overview of the whole course can be found in the Delivery Guide.

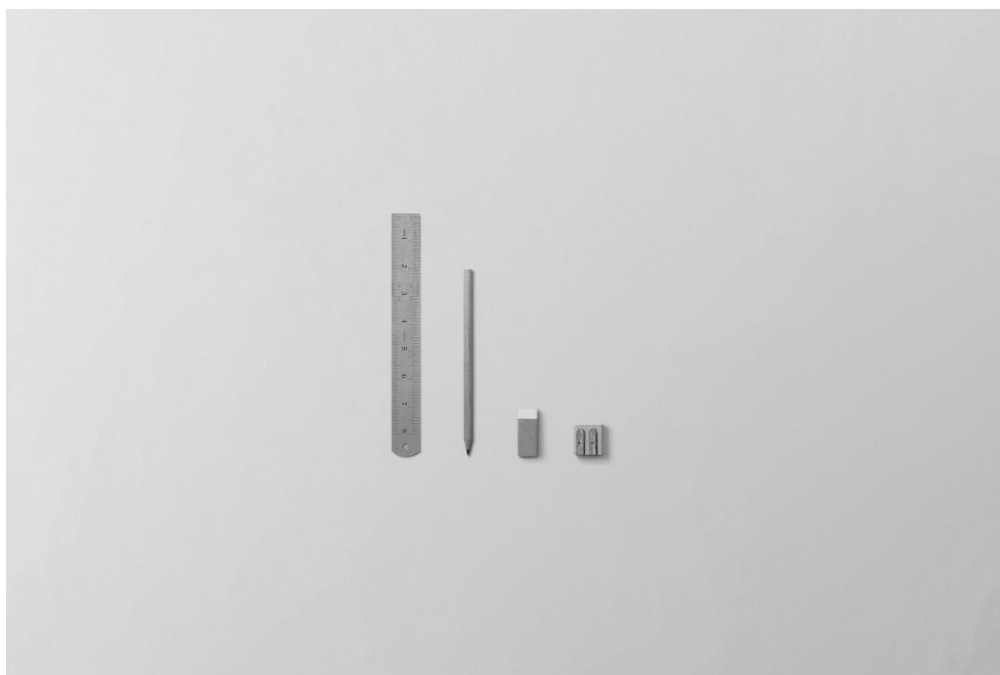


Fig. 1

CONTENTS

Aims of the Guidance for Teaching	3
Aims of the Unit Guide	3
Introduction	5
Additional ways that WJEC/Eduqas can offer support:	5
Overview of Unit 2.....	6
How to read the Specification	6
Unit 2 Teacher Guidance	7
2.1 Understanding function and meeting requirements.....	7
2.2 Proposing design solutions.....	9
2.3 Communicating an engineered design solution	11
2.4 Solving applied engineering problems.....	12
Controlled assessment	14
Controls	14
Further Guidance	16
Release of Controlled Assessment Assignment Briefs	17
Presentation	17
Assessment of Unit 2	18
FAQS	18
Glossary for Unit 2.....	23

INTRODUCTION

The WJEC Level 1/2 Vocational Award in Engineering (Technical Award), approved by Ofqual and DfE for performance qualification tables in 2024 (first teaching from September 2022), is available to:

- all schools and colleges in England and Wales
- subject to local agreement, it is also available to centres outside England and Wales, for example in Northern Ireland, the crown dependencies of the Isle of Man and the Channel Islands, and in British overseas territories, and to British forces schools overseas. It is not available to other overseas centres.

It will be awarded for the first time in January 2024, using grades Level 1 Pass, Level 1 Merit, Level 1 Distinction, Level 1 Distinction*, Level 2 Pass, Level 2 Merit, Level 2 Distinction, Level 2 Distinction*.

ADDITIONAL WAYS THAT WJEC/EDUQAS CAN OFFER SUPPORT:

- sample assessment materials and mark schemes
- exemplar materials
- face-to-face CPD events
- examiners' reports on each question paper
- direct access to the subject officer
- free online resources
- Exam Results Analysis
- Online Examination Review
- Regional Support team (England centres only).

OVERVIEW OF UNIT 2

Designing Engineering Products

(20% of the qualification)

Overview of the unit

Unit 2 allows learners to explore how an engineered product is adapted and improved over time, and it offers learners the opportunity to apply their knowledge and understanding to adapt an existing component, element or part of the engineering outcome that they produced for Unit 1.

2.1	Understanding function and meeting requirements
2.2	Proposing design solutions
2.3	Communicating an engineered design solution
2.4	Solving applied engineering problems

HOW TO READ THE SPECIFICATION

WJEC/Eduqas Vocational Award (Technical Awards) specifications are written to be transparent and easy to understand.

The amplification provided uses the following four stems:

- 'Learners should know' has been used for the recall of facts such as: legislation and definitions.
- 'Learners should know and understand' has been used for the majority of the unit content where knowledge needs to lead to a sense of understanding.
- 'Learners should be aware of' has been used when the volume of content is quite extensive, and learners do not need to understand all aspects in detail.
- 'Learners should be able to' has been used when learners need to apply their knowledge to a scenario or practical situation.

The amplification provided includes all of the assessable content for the relevant section, unless it states, '*e.g.*,' '*including*' or '*such as*'. In these cases, the amplification lists relevant content, which should be expanded upon in an appropriate way, taking account of learners' needs and interests. The use of the word '*including*' indicates compulsion (i.e. a question could be specifically set on that aspect). The use of the words '*e.g.*' or '*such as*' are for guidance only, and an alternative can be chosen.

UNIT 2 TEACHER GUIDANCE

2.1 Understanding function and meeting requirements

Content Amplification	Teacher Guidance
<p>2.1.1 Learners should be able to identify primary features of the product, such as:</p> <ul style="list-style-type: none"> • electrical components: <ul style="list-style-type: none"> • connections • LEDs • resistors • fuses • diodes • power supplies • mechanical components: <ul style="list-style-type: none"> • fixings (nuts, bolts, washers, etc) • clamping devices • adjusting mechanisms • properties of component materials: <ul style="list-style-type: none"> • conductivity • friction • durability • quality. 	<p>This information will have been provided in the drawings and information from Unit 1.</p> <p>The components should be familiar to learners, but it is not expected that they know the complexities of each one. However, they should understand the purpose or function of the listed components.</p> <p>It is recommended that learners should become familiar with these through a range of tasks in Year 10 or early in the course, such as disassembly or small theory tasks.</p> <p>A number of the properties in this Section also appear in Unit 3, Section 3.2.1.</p> <p>There are also opportunities to combine the delivery of Section 2.1.1 with use of formulae in Unit 3 Section 3.4.1 (Ohms law & mechanical advantage).</p>

2.1.2	<p>Learners should be aware of features of other engineered products that may have similar needs to their given brief such as:</p> <ul style="list-style-type: none"> • aesthetics • user/customer/client needs • safety • ergonomics • anthropometrics • mechanisms • electronics • sustainability • material properties: <ul style="list-style-type: none"> • hardness • toughness • malleability • brittleness. <p>Learners should be aware of why and how these features are applied on other similar products.</p>	<p>Learners should be aware of how products, other than those detailed in each year's brief, have similar mechanical, physical or material properties. These can then be investigated to help learners develop a solution to the given brief.</p> <p>There are opportunities for learners to offer pictorial evidence of these products (or components/mechanisms), which should be supported by a written/annotated summary of how the product meets requirements that are similar to those of the brief.</p> <p>There are also opportunities to combine the delivery of Unit 3, Section 3.2.1 in this section.</p>
2.1.3	<p>Learners should be able to explain the functional properties of their design solutions focusing on areas, such as:</p> <ul style="list-style-type: none"> • mechanical function • electrical function • how components interrelate with one another. 	<p>Learners should be able to justify, using sketches and annotation, how they have met the relevant functional requirements of the brief in their design outcome.</p>

UNIT 2 TEACHER GUIDANCE

2.2 Proposing design solutions

Content Amplification	Teacher Guidance
<p>2.2.1 Learners should be able to:</p> <ul style="list-style-type: none"> • identify existing solutions already available that meet or partly meet the problem of the brief • generate ideas related to the engineered solution • generate a range of solutions that meet the given brief and address the problem set • explore implementation of ideas. <p>Learners should be able to develop a range of ideas through to a solution including testing and modelling.</p>	<p>Learners should know and understand that similar solutions to the ones that they are designing may already exist in a range of other products. For example, learners looking at how a bike alarm can be made to fit on a tubular bike frame would gain an insight into solving or developing a solution by looking at how certain bike lights are mounted.</p> <p>Learners will need to generate a range of sketches supported by annotation. Learners may decide to use computer aided design (CAD) to produce and annotate individual design solutions.</p> <p>Learners should know and understand that a final design solution should be arrived at through development.</p> <p>Testing and modelling using suitable materials is expected to form a significant part of this process. Testing could include items such as mechanism function or aesthetics.</p>
<p>2.2.2 Learners should be aware that design solutions must meet a range of specific criteria, including any limitations set by the brief such as those relating to:</p> <ul style="list-style-type: none"> • materials • sizes • tolerances • cost • operational parameters. <p>Learners should be able to determine the most suitable engineering solution by using a suitable evaluative method such as:</p> <ul style="list-style-type: none"> • a SWOT analysis • a review/evaluation against the given design specification • a review/evaluation against the brief. 	<p>Learners should be aware of the need to ensure that all aspects linked to the brief and design specification are addressed as a part of their design process.</p> <p>This should include the application of an appropriate evaluative method. Learners should be familiar with a range of evaluative methods through work completed in practices and trials.</p> <p>It is important that the learner is able to review their design solutions against both the brief and provided design specification to ensure that the final proposal is fit for purpose.</p>

2.2.3	<p>Learners should be able to communicate design ideas in a suitable media appropriate to the information being presented. This should:</p> <ul style="list-style-type: none"> • convey meaning • use appropriate language • have a logical structure • clearly present the information using either ICT or traditional hand-written/illustration methods • use appropriate terminology • include visual support such as simple models, CAD visuals or test rigs. 	<p>Learners should be aware of a range of suitable methods by which they can present their design proposals according to this section.</p> <p>Attention should be given to the effective use of technical terminology, which is appropriate to the engineering solution.</p> <p>2.2.3 may contain visual modelling which may have been created in 2.2.1 but should now be presented in this Section. Rendered CAD visuals are appropriate, as are traditional modelling techniques. The focus of this area of content should be the effective and appropriate presentation of the overall design proposal to a potential client.</p>
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UNIT 2 TEACHER GUIDANCE

2.3 Communicating an engineered design solution

Content Amplification	Teacher Guidance
<p>2.3.1 Learners should be able to produce an engineering specification that includes:</p> <ul style="list-style-type: none"> • precise details of engineering requirements, presented in textual form, and/or included on drawings • specification points that must be interpreted before work commences, such as: <ul style="list-style-type: none"> • materials information • technical details • finishing details. 	<p>Learners should be able to produce an engineering specification which covers the amplification for 2.3.1. Learners should already have experience of this from their interpretation of the engineering specification supplied to them from Unit 1.</p> <p>The specification needs only to address the proposed modifications detailed in the brief for Unit 2 and does not need to include any details from Unit 1.</p> <p>Evidence for this section may also contain sketches and notes to clarify key points or details.</p>
<p>2.3.2 Learners should be able to produce engineering drawings, using traditional instruments or CAD based software, of a final proposed engineered product to recognised standards including:</p> <ul style="list-style-type: none"> • a 3rd angle orthographic projection • an isometric image. <p>Learners should be able to produce engineering drawings that include:</p> <ul style="list-style-type: none"> • dimensions and associated symbols <ul style="list-style-type: none"> • diameter, circumference, radius, height, depth, width • conventions <ul style="list-style-type: none"> • title block • dimension lines • extension lines • centre lines • metric units of measurement • hidden detail • scale. 	<p>Learners should know and understand how to produce engineering drawings which detail their final design solution.</p> <p>Learners should focus on 3rd angle orthographic projection for the main views, supported by an isometric drawing to aid in displaying clarity.</p> <p>Conventions should be followed as detailed in the amplification and close attention should be given to the mark scheme for mark band expectations.</p> <p>It is appropriate to produce the drawings traditionally or through the use of CAD, however, the afore mentioned expectations apply to both methods of presentation.</p>

UNIT 2 TEACHER GUIDANCE

2.4 Solving applied engineering problems

Content Amplification	Teacher Guidance
<p>2.4.1 Learners should be able to:</p> <ul style="list-style-type: none"> calculate basic areas and volumes of simple geometric shapes interpret estimates with regards to pricing materials and production rates apply OHM's law to simple problems relating to current, resistance and voltage apply simple ratios and equations to determine mechanical advantage in: <ul style="list-style-type: none"> simple gears levers pulleys calculate linear dimensions on sketches or drawings using datum points. <p>Learners should be able to produce responses to engineering problems that:</p> <ul style="list-style-type: none"> use units of measurement – meters (m) and millimetres (mm) apply appropriate scale to sketches and drawings. 	<p>Learners should be able to apply the listed amplifications when required to by the Unit 2 brief. For example, the specification may require the learner to calculate any wasted material from stock sizes of a component part that they designed to meet the brief.</p> <p>Other situations may require calculations of gear ratios on a specific section of an item that must be applied according to the brief. For example, using gears to apply mechanical advantage to a can crusher.</p> <p>Another situation may require learners to detail a particular orthographic view using datum points to calculate the dimensions of the part.</p>
<p>2.4.2 Learners should be able to apply methods of testing to justify material selections that are fit for purpose and meet the design specification.</p>	<p>Learners should know and understand how to apply appropriate tests that can be applied to justify material selections on their final design. This area of content is linked to section 2.2.1 in Unit 2, and 3.2.1 in Unit 3.</p> <p>Learners should record their testing with photographic evidence and notes on results.</p>

2.4.3	<p>Learners should be able to suggest and justify appropriate methods for producing the component parts of their engineering outcome, such as:</p> <ul style="list-style-type: none"> • method for material removal • methods for shaping and manipulating materials • joining and/or assembly methods • heat and chemical treatments methods finishing. 	<p>Learners should be able to specify appropriate engineering techniques to produce their design solutions, such as using a lathe to reduce a stock bar to a required dimension.</p> <p>The purpose of this section is to explain how each part would be produced. This could be done as an engineering specification (again, this refers to the engineering specification provided in Unit 1). It may also include diagrams, sketches and annotation to explain the learner's reason for selection.</p> <p>There is no expectation of the learner to produce sequences or timings for production for this section, but instead to focus on the key processes.</p>
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CONTROLLED ASSESSMENT

CONTROLS

Guide to Controls

There are a number of different aspects that are controlled within the internal assessment of our Vocational Awards. These are:

- supervision
- guidance
- resources
- collaboration.

Redrafting

Re-drafting is allowed within the time of the controlled assessment and without teacher feedback.

Time

The total time allocated for assessed tasks is 10 hours. Candidates must not exceed this time. Unit 2 tasks feature recommended timings that are for guidance only. Centres should discourage candidates from exceeding the recommended times or devoting insufficient time to this work.

Supervision

One level of supervision features throughout the Unit 2 assessment:

Direct supervision	The use of resources is tightly prescribed. The centre must ensure that:
	<ul style="list-style-type: none"> all candidates are within direct sight of the supervisor throughout the session(s) display materials which might provide assistance are removed or covered there is no access to e-mail, the internet or mobile phones candidates complete their work independently interaction with other candidates does not occur no assistance of any description is provided.
	Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions.
	Where direct supervision is specified, the centre must ensure that the JCQ No Mobile Phone poster and JCQ Warning to Candidates is displayed.

Guidance

Two levels of guidance feature throughout the Unit 2 assessment:

Category of Advice/Feedback:	Direct	Indirect
Teachers can:		
Review candidates' work and provide oral and written advice at a general level in order to secure a functional outcome.	X	✓
Evaluate progress to date and propose broad approaches for improvement.	X	X
Provide detailed specific advice on how to improve drafts to meet assessment criteria.	X	X
Give detailed feedback on errors and omissions which leave candidates with no opportunity to show initiative themselves.	X	X
Intervene personally to improve the presentation or content of work.	X	X

Resources

Two levels of resources feature throughout the Unit 2 assessment:

Not permitted	<p>The use of resources is not allowed.</p> <p>Access to the Internet is not permitted.</p> <p>Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions.</p> <p>If the specification allows candidates to bring their own computers or other electronic devices into formally supervised sessions, appropriate checks must be carried out to ensure that all materials stored on the devices is permissible and that access to the internet is disabled.</p>
Permitted	<p>Candidates have access to resources and/or preparatory notes as directed by the brief or unit guidance.</p> <p>Candidates' work must remain within the centre at all times and must be stored securely between timetabled sessions.</p> <p>Centres should refer to specifications for subject-specific guidance.</p>

Where the level of control is 'permitted', candidates' notes are limited as follows:

Task:	Resources permitted:
1a(ii)	Access to the internet is permitted for research of other engineered products.

Collaboration

One level of collaboration features in the Unit 2 assessment:

Not permitted	Candidates should not collaborate in any way during the task.
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FURTHER GUIDANCE

Learners will be expected to develop the outcome produced in Unit 1 based on a provided brief which highlights improvements and market feedback from the original product. Learners will then be required to add these design improvements into the existing Unit 1 design.

Learners will have already produced the original design, and this may be used as a physical resource for designing the Unit 2 requirement. It would prove more beneficial for learners if Unit 2 was undertaken after the completion of Unit 1. Any learner who failed to produce a Unit 1 outcome will still have access to all of the details of the original design from the provided Unit 1 documentation from WJEC.

This unit offers opportunities for testing and modelling outcomes based on a product that the learners will be familiar with and will have a good working knowledge of how it operates/functions.

Focus on this unit is the development of the improvements outlined in the provided WJEC brief and specification, and it requires learners to design/model the product only; there is no requirement to manufacture the additional outcomes.

RELEASE OF CONTROLLED ASSESSMENT ASSIGNMENT BRIEFS

Controlled assessment briefs will be released in June of each year. Controlled assessments will be labelled with the date of their release and the date for submissions, for example the controlled assessment brief released in June 2024 must be submitted for moderation in either January or May 2025.

PRESENTATION

Candidates are able to present work using a variety of methods, which can be either written or digital.

Candidates should be encouraged to choose their own method of presenting their work, which can be a combination of A4 and A3 size.

Digital portfolios should be submitted in PDF format with images at a suitable resolution to allow a moderator to see the detail in the work. This is particularly important for any testing or modelling which the learner has undertaken.

CAD drawings and/or renders should be printed and added to the learner's submission folder unless the whole submission is digital. Centres should avoid submitting mixed folders where some parts are on paper and other parts are digital.

ASSESSMENT OF UNIT 2

Unit 2: Designing engineering products

Controlled Assessment: 10 hours

20% of qualification

40 marks: 60 UMS

An assignment brief will be provided by WJEC that will include a scenario and several tasks available via the WJEC Secure Website.

Centres must follow the instructions for running controlled assessments in the Administration Guide and within each Unit Guide. In line with these instructions, centres are required to have in place a controlled assessment policy (which can be part of a centre's NEA policy); this will be checked as part of the centre and qualification approval process.

The assessment objective weightings for Unit 2 are:

AO1	AO2	AO3
1.5%	11%	7.5%
3 marks	22 marks	15 marks

FAQS

Can learners resit the Unit 2 assessment?

Candidates may resit the internally assessed unit prior to certification but cannot improve previously submitted work. The best uniform mark score from the attempts will be used in calculating the final overall grade.

Candidates who are unhappy with the grade awarded for the qualification may choose to resit one or more units following certification.

Where the candidate resits the internally assessed unit, the higher of the uniform mark score from either the initial attempt or the resit attempt will be used in calculating the overall grade. The candidate will also need to resit the externally assessed unit to satisfy the terminal rule requirement for the qualification and only the uniform mark score from the resit attempt will be used in calculating the final overall grade, even if this is lower than the previous attempt.

What is the entry code for this unit?

		Entry Code
Unit 2	Internal	5799U2
Cash in code		5799QA

Is this assessment compulsory?

Yes.

When can candidates submit the Unit 2 assessment?

Assessment opportunities will be available in January and May/June each year, until the end of the life of this specification.

May 2023 will be the first assessment opportunity for Unit 2.

Are candidates assessed on their spelling, punctuation and grammar in this assessment?

No, although learners are reminded of the need for good English and orderly, clear presentation in their answers.

Will the assessment objective weightings remain the same throughout the life of the specification?

Yes.

How is the unit reported?

This unit will be graded Level 1 Pass, Level 1 Merit, Level 1 Distinction, Level 1 Distinction*, Level 2 Pass, Level 2 Merit, Level 2 Distinction, Level 2 Distinction*.

Where can I access the Controlled Assessment assignment briefs?

The Controlled Assessment assignment briefs can be found in the Candidate and Assessor pack on the secure website under [WJEC \(wjecservices.co.uk\)](https://wjecservices.co.uk).

How will I know which assignment brief to use?

Candidate and Assessor packs will be clearly labelled with the release date and the year of submission for that brief. Centres must ensure that they provide learners with the correct brief for the year during which learners will be submitting their controlled assessment.

What happens if a candidate has done the wrong brief?

Centres should contact the subject team at WJEC as soon as possible. The centre may be required to submit the relevant JCQ form to ensure that the learners is not penalised.

Will the tasks remain the same throughout the life of the specification?

Tasks are intended to remain the same throughout the lifetime of the specification, however centres should refer to the published assessment brief each year in case changes to the tasks do have to be made.

Do learners have to use the published contexts given for the controlled assessment tasks?

Yes. The context will change every year, and learners must complete tasks according to the context that is included as part of the assessment brief for the appropriate year of submission.

When should learners complete the Controlled Assessment?

Controlled Assessment tasks may be completed and assessed at any suitable time during the course. However, centres need to ensure they have delivered the content needed for candidates to be able to access marks allocated to all aspects of the relevant Controlled Assessment.

Are candidates permitted to work together on any part of their Controlled Assessment?

No. Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

How long should learners spend on their Controlled Assessment?

Learners should spend 10 hours on their Controlled Assessment tasks. Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

Can learners complete their Controlled Assessment outside of the classroom?

No. Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

Are there any word or page restrictions for the Controlled Assessment?

No. Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

How should learners present their Controlled Assessment work for submission to WJEC?

Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

Can the work be a combination of word processed and handwritten?

Yes.

Can learners use the internet during the completion of their Controlled Assessment?

Learners are permitted to use the internet when undertaking task 1(a)(ii). Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

Can teachers provide guidance about candidates' Controlled Assessment work?

Teachers are permitted to review candidates' work and provide oral and written advice at a **general** level in order to secure a functional outcome in certain tasks. Please see the Administration Guide and page 14 of this document for more information on how to manage the Controlled Assessment.

Are learners permitted to redraft their work?

Once the task is finished and the final assessment made, no further amendments may be made. Please see the Administration Guide and page 13 of this document for more information on how to manage the Controlled Assessment.

How will work be submitted to WJEC?

Please see the Administration Guide and page 13 of this document for more information on how to manage the submission of the Controlled Assessment.

Is there a set number of images that are requested and are there any min/max sizes?

For this unit, images should be limited to any testing outcomes that learners have undertaken. These could include images of materials testing or sketch models made during the iterative stage of designing. They may be included on sketch sheets or as separate pages.

What provisions will be made for learners who might struggle to access the Controlled Assessment activities such as learners with disabilities or learners who have specific learning needs?

WJEC will follow the guidance and rules on reasonable adjustments found in the Joint Council for Qualifications (JCQ) document: Access Arrangements and Reasonable Adjustments: General and Vocational Qualifications.

We believe that, as a consequence of the provision for reasonable adjustments, very few learners will have a complete barrier to any part of the assessment in WJEC Level 1/2 Vocational Award in Engineering (Technical Award). We recognise, however, that Controlled Assessment activities can provide challenges for learners with particular disabilities. We will be pleased to respond to queries from centres on an individual basis should they seek advice on delivery or assessment of the qualification for a particular learner or group of learners, and to discuss what reasonable adjustments might be appropriate to remove or minimise the disadvantage experienced by a learner with disabilities studying the WJEC Level 1/2 Vocational Award in Engineering (Technical Award).



Fig. 2

GLOSSARY FOR UNIT 2

Term	Definition
Anthropometrics	Designers and Engineers use anthropometric data to help make sure a product will be comfortable for the user. Products are often designed for the majority of the population, considered to be between the 5th and 95th percentile.
BS 8888: 2020 Technical product documentation and specification	BS 8888 is the UK's national framework standard for engineering drawings. It explains the way in which engineering drawings outline and present these specifications. It covers all the symbology and information that engineers, and designers need to include on their drawings, be they manually produced (2D), or in 3D, created using CAD systems and 3D modelling.
CAD Visuals	These are printed or digital outcomes which show a pictorial representation of the final engineering solution. They usually show coloured renders displaying materials and finishes but can also be simple line drawings to show the design.
Datum Points	Any reference point of known or assumed coordinates from which calculation or measurements may be taken.
Engineering Drawing	Engineering drawings, for the purpose of Unit 2, are the drawings which learners produce as a part of their response for explaining their engineering solution in detail. They include Orthographic and Isometric views detailed below as well as dimensional (size) details, information on finishes and tolerances etc. These can be produced traditionally using a drawing board or by CAD methods using suitable software.
Ergonomics	A branch of science that aims to learn about human abilities and limitations, and then apply this learning to improve people's interaction with products, systems and environments.
Isometric View	A measured 3D view or representation of a part or product. They are constructed using 30° (or 30°/60°) grids.
Engineering specification	A set of instructions which list key steps or information such as tolerances, finishes etc.
OHM's law	A formula used to calculate the relationship between voltage, current and resistance in an electrical circuit.
Operational parameters	Parameters that are applied during manufacture which may then be fed back about operations during the production stages to improve quality or productivity.
Orthographic View	This is the standard set of views used in an engineering drawing to display sizes and details about a product. Typically, views would include a front, end (side, sometimes left and right) and a plan (top) elevation (or views).
Testing	This can include visual models of proposed modifications to the design.

Acknowledgments:

Fig. 1	Image by Free-Photos from PixaBay
Fig. 2	Image by Free-Photos from PixaBay