

Engineering and Manufacturing T Levels Team



Scott Wilkins

Industry Manager Engineering and Manufacturing







E: Scott.wilkins@cityandguilds.com



Robert Stott

Industry Manager Engineering and Manufacturing







E: Robert.stott@cityandguilds.com



Michael Scarrott

Product Specialist







E: Michael.Scarrott@eal.org.uk



Simon Yorke

Lead Technical Advisor Apprenticeships, EPA, Qualifications







E: Simon.yorke@cityandguilds.com



Samantha Ashman

Technical Advisor Engineering T Levels





in

E: Samantha.ashman@cityandguilds.com



Alison Whittle

Technical Advisor - Post 16







E: Alison.Whittle@cityandguilds.com

Agenda

- Welcome
- Engineering & Manufacturing Pathway
 - Structure and assessment of Core component

Assessment contribution = Core & OS

Qualification handbook

17 Core components

Core examination

Exemplar of core examination

TQ scheme of assessment per pathway

Employer Set Project

Exemplar ESP

Occupational Specialism

Exemplar Occupational Specialism

- Industry Placements
- How we support you
 - What next?
 - Resources
- Opportunity for Questions

Engineering and Manufacturing T Level programme composition

1400-1800 GLH hours over two years. Achievement of T Level must include all components. UCAS points will be attached and will be equivalent to 3 A levels.

Core

50% Total TQ time

Graded A* - E

Paper 1 Maths & Science

Paper 2 Engineering Concepts
ESP Employer Set Project

Occupational specialism

50% Total TQ time

Graded Pass/merit/distinction

Based on occupational maps

No less than 50% of the total qualification planned time

Assessment:

External set and marked exams

Assessment:

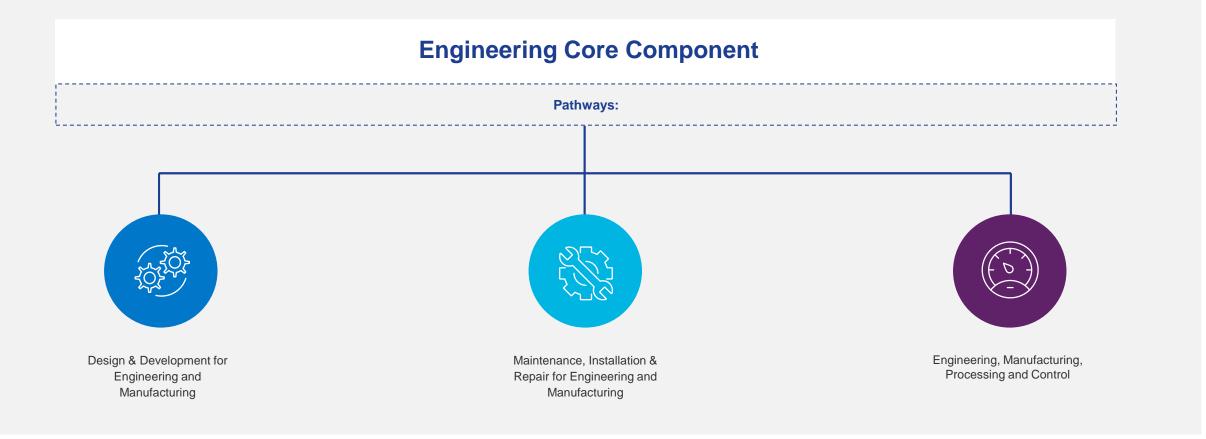
Practical assignment(s)

Industry Placement 315-420 hours Min 45-60 days

Maths & English at a minimum of GCSE or Functional Skills Level 2

Employability, Enrichment & Pastoral Requirements

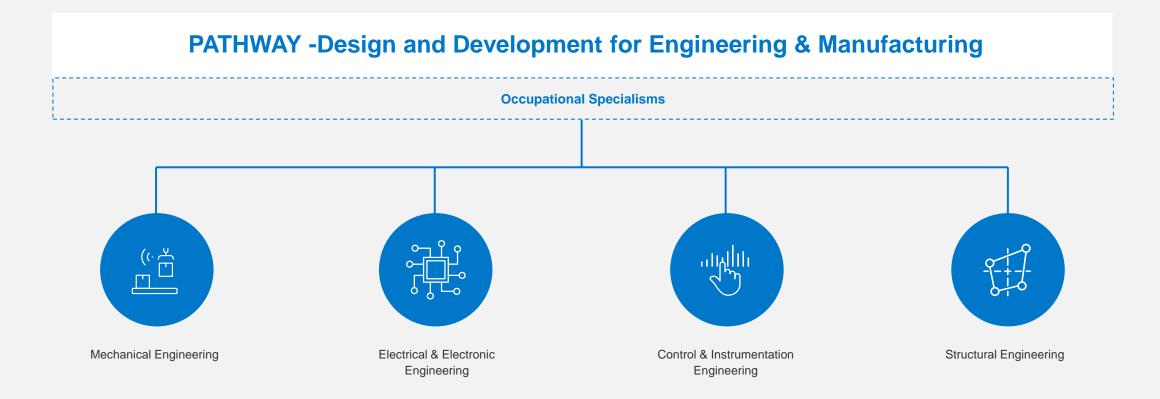
Technical Qualification overview for Engineering:



Learners must complete:

- Engineering Core
- 1 Occupational specialism within a pathway

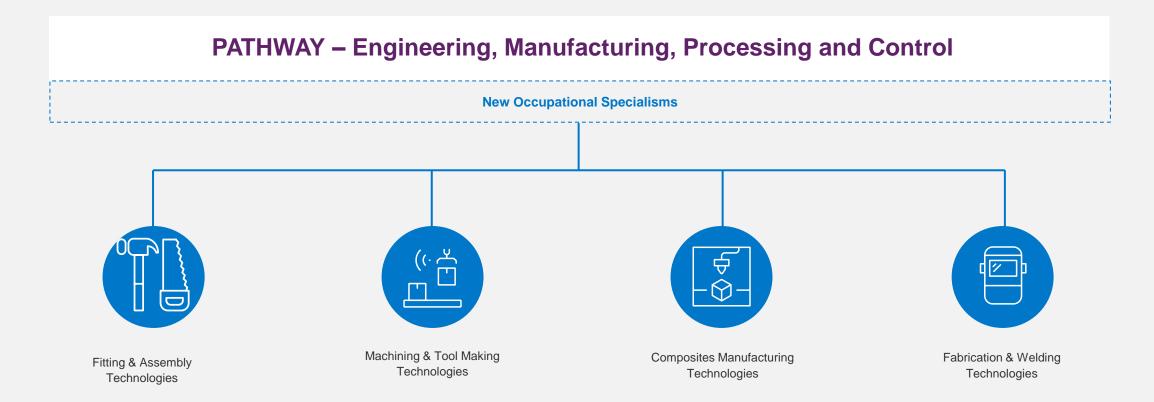
Route: Engineering and Manufacturing



Route: Engineering and Manufacturing

PATHWAY - Maintenance, Installation and Repair for Engineering and Manufacturing Occupational Specialisms Mechanical Mechatronic Electrical & Electronic Control & Instrumentation Light & Electric Vehicle

Route: Engineering and Manufacturing



NB: Processing Technologies is paused from the original outline content



Assessment contribution = Core & OS

The overall assessment weighting for the core and the occupational specialism is 50:50

	Core	Occupational Specialism
	50%	50%
GLH	680	680
Grade	A* - E	P/M/D

Assessment core	Overall contribution
Core examination 1	35%
Core examination 2	35%
Employer-set project	30%

Qualification Handbook - Core

300

Engineering common core content

Level:	3
GLH:	680
Assessment method:	Externally set exam
	Employer-set project

What is this component about?

An introduction to Engineering and Manufacturing, designed to help learners choose a specific pathway and specialism once the common core is delivered.

It covers the theoretical knowledge of the Engineering and Manufacturing industry and various disciplines across all sectors that are indicative to the industry.

Learners gain an understanding of what theoretical principles and practices integral to the industry and sector are required to work in it.

Learners will develop their knowledge and understanding of, and skills in:

- Knowledge of working within the engineering and manufacturing sectors and the professional responsibilities, attitudes, and behaviours required to do so.
- Knowledge of the essential mathematics and science for engineering and manufacturing.
- Knowledge of mechanical, electrical and mechatronic principles.
- · Knowledge of health and safety principles.
- An understanding of the business management required within the sector to provide a product or service with success.
- Skills in project management and delivery of a project.

Learners may be introduced to this component by asking themselves questions such as:

- What are the different sectors in engineering and manufacturing?
- · What does the future look like for this sector, where could it take me?
- What mathematics and science are involved in engineering and manufacturing?
- · How do I read engineering diagrammatic representations?
- · How do I manage and present a project?

Qualification Handbook - Core

Learning Outcome

This section of the specification outlines the subject or topic that needs to be delivered and assessed. Criteria are often supported by the "range"

What do learners need to learn?
The primary purpose of these sections is to support the delivery of the content in the criteria.
These sections provide context In relation to the depth and breadth to which a subject or topic needs to be taught.

1 Working within the engineering and manufacturing sectors

1.1 Key principles and methodologies in engineering and manufacturing design.

Range:

Principles

Types of manufacturing process (wasting, forming, shaping, joining, finishing, casting, additive). Fitness for purpose (influences on design and manufacture, functional requirements, environmental requirements).

User requirements (design brief, specification, needs to be met).

Approaches to design (linear design, iterative design, inclusive design, user centred design, anthropometric data (ergonomic design), design for manufacture, design for assembly, sustainable design, 6Rs (reduce, refuse, rethink, repair, reuse, recycle)).

Skills 4

DD-CSA.

DD-CSC.

DD-CSD.

Research and testing methodologies.

Methods of communicating design requirements to technical and non-technical audiences.

What do learners need to learn?

How different types of manufacturing processes influence the design of engineered products.

How different requirements affect the user and designs related to the manufacture of products.

The steps of the linear and iterative design processes and the contribution that testing makes to achieve a suitable and effective design.

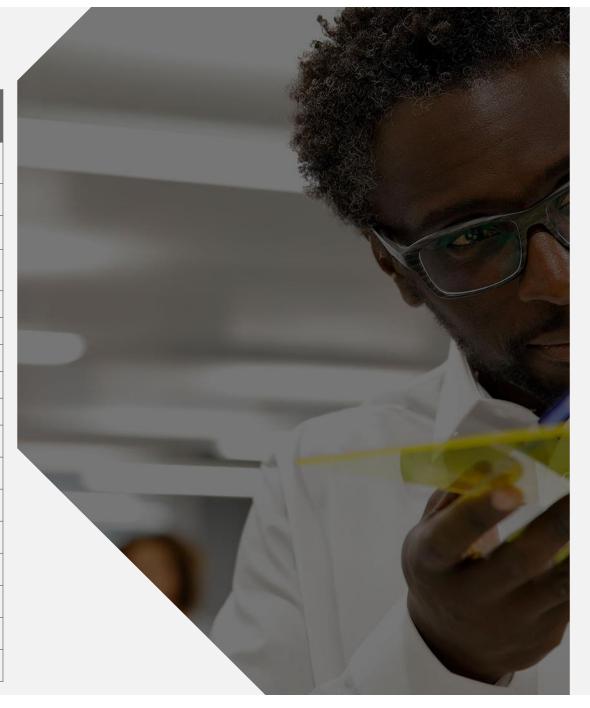
How to interpret anthropometric data.

Provides the detail of the information required to be delivered as part of that topic.

Relate to Core Skills and general competencies in English, Mathematics and Digital Skills.

Technical Qualification - Core

Element	Title	GLH
1	Working within the engineering and manufacturing sectors	30
2	Engineering and manufacturing past, present, and future	30
3	Engineering representations	40
4	Essential mathematics for engineering and manufacturing	90
5	Essential science for engineering and manufacturing	90
6	Materials and their properties	60
7	Mechanical principles	35
8	Electrical and electronic principles	35
9	Mechatronics	30
10	Engineering and manufacturing control systems	30
11	Quality management	30
12	Health and safety principles and coverage	60
13	Business, commercial and financial awareness	30
14	Professional responsibilities, attitudes, and behaviours	15
15	Stock and asset management	15
16	Continuous improvement	30
17	Project and programme management	30



Core Content Examination

Paper 1 –

Maths and Science Principles for Engineering (6 Elements) (2hrs 30mins)

Paper 2 –

Engineering in Context (11 Elements) (2hrs 30mins)

17 Elements in total to make up the core

	Element – Paper 1	GLH
4	Essential mathematics for engineering and manufacturing	90
5	Essential science for engineering and manufacturing	90
6	Materials and their properties	60
7	Mechanical principles	35
8	Electrical and electronic principles	35
9	Mechatronics	30

	Element – Paper 2	GLH
1	Working within the engineering and manufacturing sectors	30
2	Engineering and manufacturing past, present, and future	30
3	Engineering representations	40
10	Engineering and manufacturing control systems	30
11	Quality management	30
12	Health and safety principles and coverage	60
13	Business, commercial and financial awareness	30
14	Professional responsibilities, attitudes, and behaviours	15
15	Stock and asset management	15
16	Continuous improvement	30
17	Project and programme management	30

Exemplar Core Exam Paper 1

4 A robotic delivery vehicle of mass 500 kg is being used to move wagons containing materials around a factory. The wagon and materials have a combined mass of 125 kg. The robotic delivery vehicle, which is initially travelling at 2.4 m s⁻¹, collides with the stationary wagon and the two become fixed together and move as a single mass.

Calculate the common velocity after the collision.

(4 marks)

17 A company manufactures hard hats from a metal alloy, such as the one shown in Figure 5. The design specifies that the metal should have a crystalline structure. Due to a manufacturing issue, the metal has been produced with an amorphous non-crystalline structure.

Explain how this will affect the performance of the hard hat when it is subjected to an impact. (4 marks)



Figure 5

Source: www.forestry-suppliers.com

7 The shape in Figure 1 must be accurately measured before manufacturing. Calculate the length of side KL.

(3 marks)

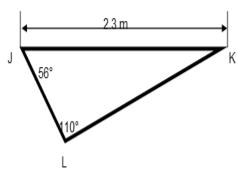


Figure 1 - Not to scale

A company is making a chain for a ship's anchor that a ship will use when at sea. They are using a ferrous metal.

The company has three potential processing techniques that could be used to make the links in the chain:

- Casting
- Forging
- Welding bent pieces together.

The chain also needs to be protected from corrosion.

Suggest which of the three processing techniques would be suitable chain and a method to improve its corrosion resistance, justifying your suggestions compared to the alternatives.

Technical Qualification scheme of assessment components – Design & Development Pathway

Assessment component	Method	Duration	Marks	Weighting	Marking	Grading
Exam paper 1	Externally set exam	2.5 hours	100	35%	Externally marked	
Exam paper 2	Externally set exam	2.5 hours	100	35%	Externally marked	This component will be awarded on the grade scale A* -E
Employer-set project	Externally set project	18.5 hours	90	30%	Externally marked	
Occupational Specialism Component – Learners must complete all assessment components						
Assessment component	Method	Duration	Marks	Weighting	Marking	Grading
Assessment component Mechanical engineering	Method Externally set assignment			Weighting 100%	Marking Externally moderated	Grading
•		Duration	Marks		-	Grading All occupational specialism components
Mechanical engineering Electrical and electronic	Externally set assignment	Duration 34 hours	Marks 90	100%	Externally moderated	All occupational

Technical Qualification scheme of assessment components – Maintenance, Installation and Repair Pathway

ore component – Learners must complete all assessment components						
Assessment component	Method	Duration	Marks	Weighting	- Marking	Grading
Exam paper 1	Externally set exam	2.5 hours	100	35%	Externally marked	
Exam paper 2	Externally set exam	2.5 hours	100	35%	Externally marked	This component will be awarded on the grade scale A* -E
Employer-set project	Externally set project	12.5 hours	90	30%	Externally marked	Soule / L
Occupational Specialism C	Component – Learners must co	omplete all assessment comp	ponents			
Assessment component	Method	Duration	Marks	Weighting	Marking	Grading
Maintenance engineering technologies: Mechanical	Externally set assignment	22 hours	90	100%	Externally moderated	
Maintenance engineering technologies: Mechatronic	Externally set assignment	22 hours	90	100%	Externally moderated	
Maintenance engineering technologies: Electrical and Electronic	Externally set assignment	22 hours	90	100%	Externally moderated	All occupational specialism components will be awarded on the grade scale P,M,D
Maintenance engineering technologies: Control and Instrumentation	Externally set assignment	22 hours	90	100%	Externally moderated	
Light and Electric Vehicles	Externally set assignment	22 hours	90	100%	Externally moderated	

Technical Qualification scheme of assessment components – Engineering, Manufacturing, Processing & Control Pathway

Assessment component Method Duration Marks Weighting Marking Grading							
Assessment component	Method	Duration	Marks	Weighting	Marking	Grading	
Exam paper 1	Externally set exam	2.5 hours	100	35%	Externally marked		
Exam paper 2	Externally set exam	2.5 hours	100	35%	Externally marked	This component will be awarded on the grade scale A* -E	
Employer-set project	Externally set project	15 hours	90	30%	Externally marked		
Occupational Specialism C	component – Learners must co	mplete all assessment comp	oonents				
Assessment component	Method	Duration	Marks	Weighting	Marking	Grading	
Fitting and assembly technologies	Externally set assignment	25 hours 15 minutes	90	100%	Externally moderated		
Machining and toolmaking technologies	Externally set assignment	25 hours 15 minutes	90	100%	Externally moderated	All occupational specialism components	
Composites manufacturing technologies	Externally set assignment	24 hours 15 minutes	90	100%	Externally moderated	specialism components will be awarded on the grade scale P,M,D	
Fabrication and welding technologies	Externally set assignment	26 hours 15 minutes	90	100%	Externally moderated		



Employer Set project

Scheduling of the Employer-set project assessments

The Employer-set project assessment window will occur from March to May annually. Specific dates will be released annually through the key date schedule for the following academic year.

Task	Scheduling	Task duration
1 Research	City & Guilds sets the assessment window for the centre to timetable	3 hours
2 Design	City & Guilds sets the assessment window for the centre to timetable	8 hours
3 Plan	City & Guilds sets the assessment window for the centre to timetable	5 hours
4 Present	City & Guilds sets the assessment window for the centre to timetable	2.5 hours

A supporting document and guidance will be shared in advance of the assessment to support timetabling and planning for centres, for example outlining any required resources or conditions. This will be released to centres as part of the Key Dates Schedule.

Employer-set project		
Assessment objective	Typical evidence	*Approximate weighting
AO1 Plan approach to meeting the brief	Evidence of a planned approach to work, considered sequence of activity, evidence of prioritisation, review and iterative working. Clearly structured response to brief, cohesive response with ordered sections, logical approach to referencing, research and use of sources, response completed meeting required parameters, sources used effectively and integrated into response, effective use of time allocation available for presentations.	13%
AO2 Apply core knowledge and skills as appropriate	Linking knowledge principles and ideas and applying them in context of the brief when considering compiling response use of materials, concepts etc. Applying core skills e.g. communication, planning etc appropriately throughout tasks within project.	50%
AO3 Select relevant techniques and resources to meet the brief	Analysis of key issues, drawing together considerations and considering impacts of elements on each other (not just in isolation), consideration and analysis of the reasons for doing things in a particular way.	13%
AO4 Use maths, English and digital skills	Use of correct terminology, abbreviations, units of measurement in context, consideration of audience of brief response (technical versus non-technical wording), use of calculations/diagrams etc appropriately, consideration of the use of ICT and digital methods both in brief response and in evidence presentation.	10%
AO5 Realise project outcome and review how well the outcome meets the brief	Considered analysis and evaluation of project outcome, response conclusion or evaluation, identification of solutions in response to brief problem with evidence of evaluation of other options and reasons for rejection of other options where not appropriate.	13%
*Weightings are rounded to the	nearest whole number	

Exemplar Employer Set Project

Design specification

Performance requirements for the bollard

Train express Limited wish to develop a bespoke bollard to be sites in public realm spaces outside their stations across the UK (Refer to Photograph 1). The company wish to "re-engineer' the standard self-righting internally illuminated bollard (refer to Photograph 2) used frequently in streetscapes across the UK. The new bollard is also required to monitor the number of people using a station and should be energy efficient. The specific performance requirements of the bollard are:

- The bollard shall have an overall height of 1000mm and width of 300mm.
- Each bollard needs to be able to sustain an impact loading from a vehicle. The force applied to the barrier should be calculated in accordance with BS EN 1991-1-1-1:2002 (Refer totable 1)
- The bollard is to be manufactured from a recycled or sustainable material.
- The bollard is t be fitted with technology that is able to count human presence.
- The bollard is to be lit by a low energy lighting source.
- · The bollard is to have an internal light source like the original, which ensures that it is highly conspicuous from all sides.
- · The over all aesthetic design of the bollard is to be modern and reflect intended sitting outside a railway station.
- The bollard shell should be able to withstand a minor vehicle impact and be easily replaceable.
- Train Express Limited wish to limit or eliminate any mains power source to the bollard.
- The bollard should be designed as far as possible to be vandal proof.



Photograph 2: A standard internally illuminated bollard

Table 1: Loading applied to the bollard

The horizontal characteristic force F (in KN) should be equal to that delivered by the impact of a vehicle given by:

$$F = \frac{0.5 \, m \, v^2}{\partial c + \partial b}$$

- m is the gross mass of the vehicle in (kg)
- v is the velocity of the vehicle (in m/s) normal to the barrier.
- ∂c is the deformation of the vehicle (in mm)
- \(\partial b\) is the deformation of the bollard (in mm)

Photographs





OS Exemplar (DD Mechanical)

Component	Assessment method	Overview and conditions
Occupational Specialism assignment	Externally set, externally moderated	This assignment is externally set, internally marked and externally moderated, and is designed to require the learner to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories and knowledge from across the occupational area.
		Assignments will be released to centre staff towards the end of the learners' programme, usually the week before Easter each year.
		Centres will be required to maintain the security of all live assessment materials until assessment windows are open. Assignments will therefore be password-protected and released to centres through a secure method.
		Guidance on equipment, resources and duration will be released as appropriate to ensure centres can plan for delivery of practical assignments in advance.
		Learners who fail the occupational specialism following the first submission can retake in any assessment window.
		Please note that for externally set assignments City & Guilds provides guidance and support to centres on the marking process and associated marking grid in the assessment pack for the qualification, and guidance on the use of marking grids.

Mechanical engineering

set,

externally

moderated

Content overview Externally Learners will be able to:

- Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications.
- · Evaluate systems, designs, components and processes, managing and integrating design information, proposals and specifications, to develop and improve mechanical engineering and manufacturing proposals and solutions.
- · Propose and design mechanical engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context.
- Collaborate to help manage, develop, test and quality assure mechanical engineering and manufacturing design information, systems, processes and outcomes.
- · Communicate proposals, design information and solutions, producing, recording and explaining engineering and manufacturing representations. systems, processes, outcomes, specifications and technical drawings.

Assessment overview:

Learners will be assessed against the following assessment themes:

- Health and safety
- Design and planning
- Manufacturing
- Reports

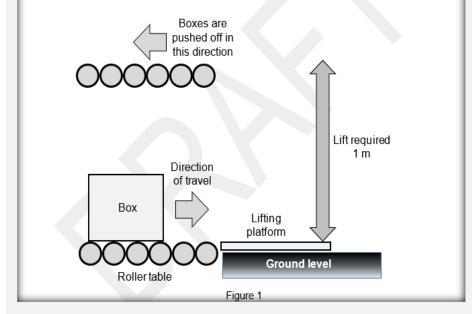
OS Exemplar (DD Mechanical)

2. Assignment brief

You are a mechanical engineer employed by an engineering company. The company have a large stores area for parts and materials.

You have been asked to design a <u>manually-powered</u> mechanical lifting device that will be used in the stores area. The aim of this device is to reduce the effort required from the workers in the stores area. Figure 1 shows an illustration of the lift required.

The device must be capable of lifting a cuboid box of maximum mass 25 kg. The maximum width, depth and height of the box are each 500 mm. The box arrives in the stores area on a roller table and is then pulled by a human worker onto the flat platform of the lifting device. The surface of the lifting platform should be 30 mm above ground level, so it is at the same height as the top of the rollers. The box must then be safely raised to a height of 1 m. It will then be pushed off onto another roller table by a human worker and the platform will be lowered to await the next box.



Design Criteria

The design criteria for this application are:

- The device must be capable of lifting a cuboid box of maximum width, depth and height 500 mm.
- The device must be capable of lifting a maximum mass of 25 kg.
- The device must be able to lift the box 1m and return to its start position.
- The surface of the lifting platform must be level with the top of the roller table upon which the box arrives, which is 30 mm above ground level.
- A human worker must be able to pull the box onto and push the box off the lifting platform.
- The lifting activity must be carried out safely.
- The lifting device must be manually powered.

Task 1 - Design

Part A

You must:

- a) Produce a detailed design specification that builds on the design criteria for the lifting device.
- b) Sketch three potential designs for the mechanical lifting device.
- c) Select one appropriate design for development with justifications.
- d) Select and justify the use of the materials and components needed for the proposed design.
- e) Carry out calculations to support the proposed design:
 - the loading applied to any components of the design that are subject to stress.
 - the mechanical advantage afforded by the design.
- f) Create engineering drawings of the proposed design using CAD software.
- g) Produce a virtual model of the proposed design using CAD software.
- h) Create a bill of materials (BoM) listing all of the parts required in your final design proposal.

Conditions of assessment:

- The time allocated for this task is 14 hours.
- You must carry out the task on your own, under controlled conditions.

Task 2 - Manufacture and test

You must:

- a) Produce a risk assessment for the manufacture of the prototype.
- b) Manufacture the prototype.
- c) Test the operation of the prototype.
- d) Produce a revision control document and any updated drawings.

Conditions of assessment:

- The time allocated for this task is 12 hours
- You must carry out the task on your own, under controlled conditions.

Controlled conditions:

- You must only work on the tasks in the allocated times.
- Assessment evidence must be handed in at the end of each session for secure storage which cannot be accessed.

Task 3 - Evaluation and implementation

You must:

- a) Produce a report evaluating the functional model. This must include:
 - . The information necessary for a third party to implement your model.
 - · Calculations of the operating efficiency of the lifting device.
 - An explanation of the test methods used and the reasons for their use.
 - An evaluation of the fitness for purpose of the lifting device and its conformance to the specification.
 - Justifications for any considerations that were taken forward, or not, following the peer review feedback
 - Any improvements or adaptions required to the model.

The report must typically be 800 words (+/- 10%).



Industry Placement

- Every T Level includes an industry placement with an employer focused on developing the practical and technical skills required for the occupation.
- These will last a minimum of 315 hours (approximately 45 days) but can last longer.
- Employers can offer industry placements as they see fit.
- Providers will ensure learners have an industry placement and will support employers offering industry placements.
- This will include assistance with the necessary paperwork, a careful planning process and support with designing the industry placement.

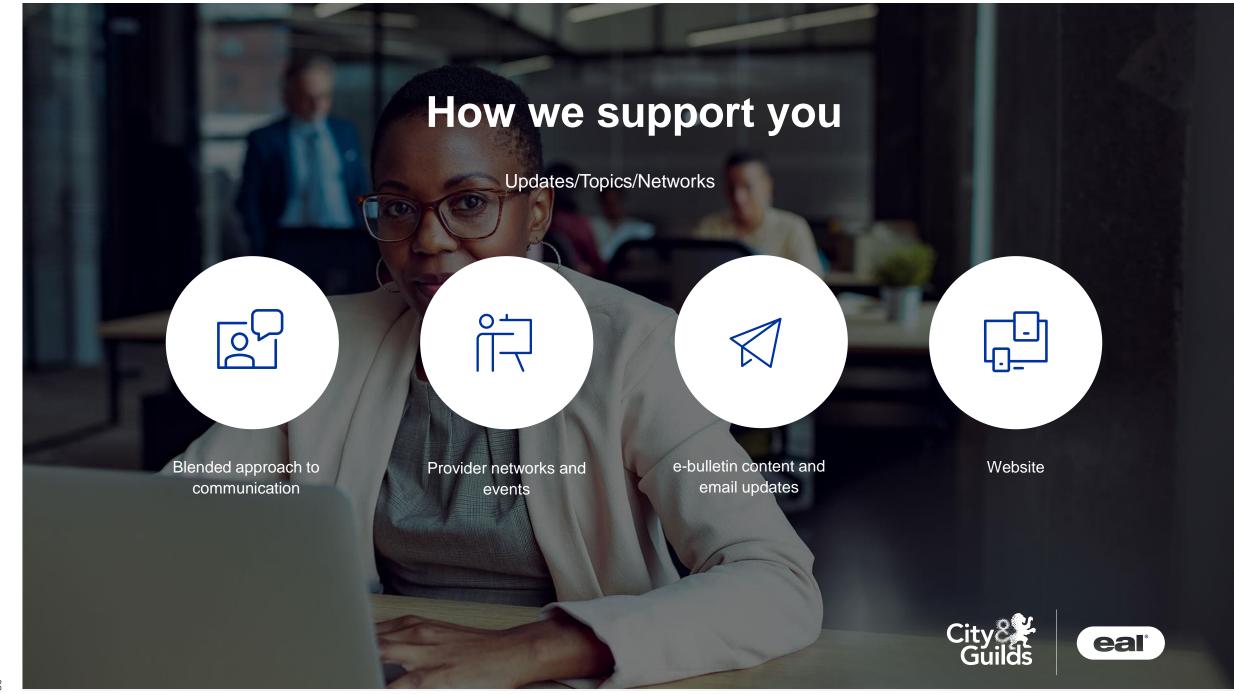
Industry Placement Guidance

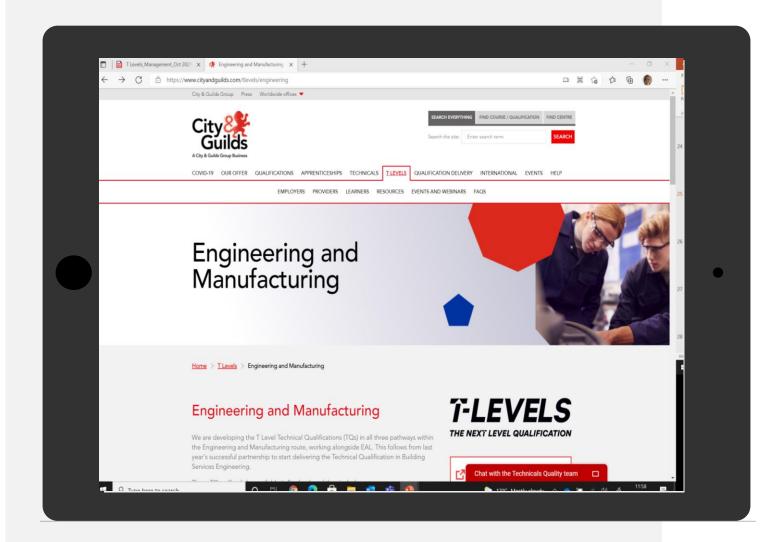
Industry Placement support – AOC website

https://www.aoc.co.uk/ip-guidance-resources

- For providers 'How to' guidance
 - Before placements
 - For students
 - During placements
- Tools and templates
 - Employer engagement
 - Before placements
 - During placement
 - Post placements
 - For employers







Support and Guidance

Ready to support eligible providers and stakeholder engagement

- Updated webpage for T Levels
- Timeline
- Provider focus groups
- Employer Industry Boards
- e-bulletins
- Draft specification
- Dedicated Technical Advisors

https://www.cityandguilds.com/tlevels/providers

Draft Specifications

https://www.cityandguilds.com/tlevels/engineering

Engineering and Manufacturing: Design and Development Technical Qualification Specification

Engineering and Manufacturing:

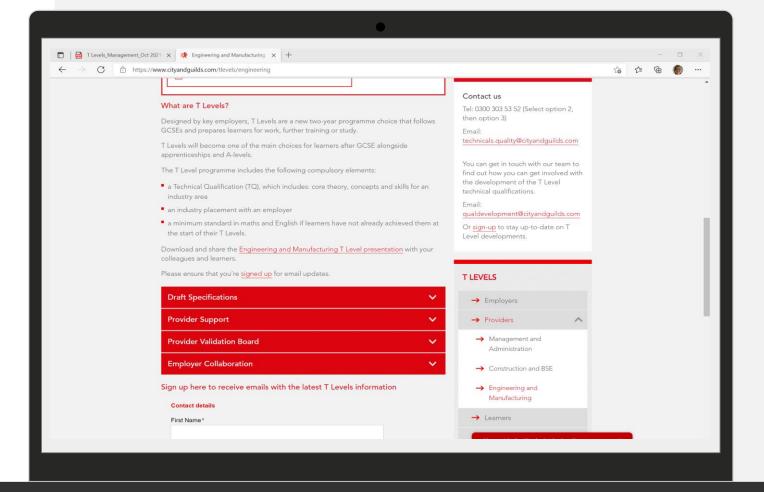
Maintenance, Installation and Repair

Technical Qualification Specification

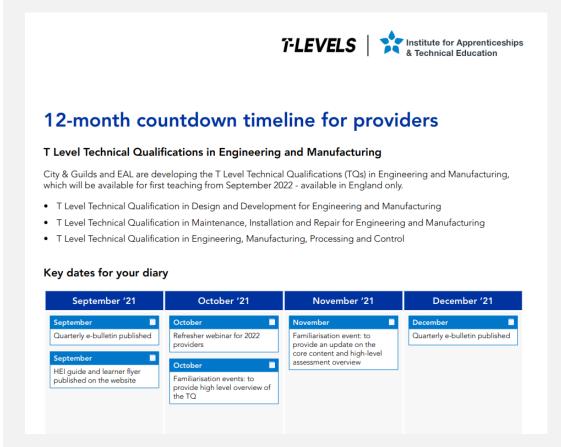
Engineering and Manufacturing:

Manufacturing, Processing and Control

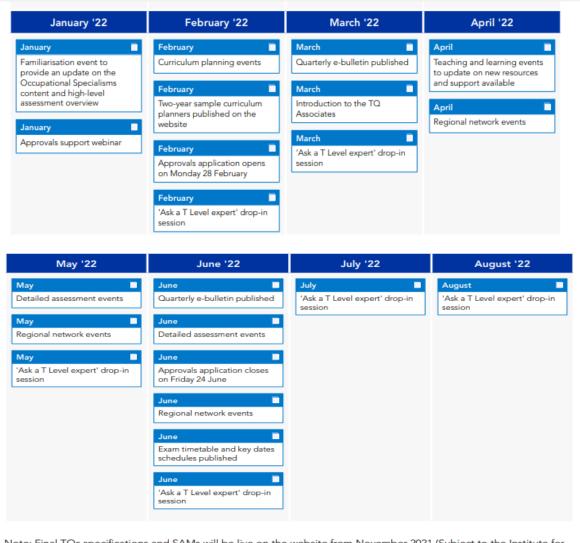
Technical Qualification Specification



12 month countdown timeline for providers



You can download the countdown timeline here <u>t-levels-wave-3-engineering-and-manufacturing-12-month-countdown</u>



Note: Final TQs specifications and SAMs will be live on the website from November 2021 (Subject to the Institute for Apprenticeships and Technical Education's approval).

Learner flyer for E&M

You can download the learner flyer here <u>t-levels-learner-flyer-engineering-and-manufacturing</u>



Coming Soon

- Resource development
- Curriculum planning support
- Workshops
 - Core (including ESP)
 - Occupational Specialisms
- Teaching & Learning Support for exam component
- Face-to-face events
- Ask a T Level expert question sessions



Websites to Support Providers

T Level Industry Placement Delivery Guidance (updated 04/11/21)

T Level industry placements delivery guidance - GOV.UK (www.gov.uk)

Introduction to T levels (updated 04/11/21)

T levels - GOV.UK (www.gov.uk)

How T Levels are funded (updated 03/11/21)

How T Levels are funded - GOV.UK (www.gov.uk)

T Levels resources for teachers and careers advisers (updated 13/09/21)

T Levels resources for teachers and careers advisers - GOV.UK (www.gov.uk)

Supporting with delivering T Levels

Support with delivering T Levels

Strategic Development Network | T Level and industry Placements

Strategic Development Network | T Level and industry placement support

ETF Foundation – T Levels

T Level Professional Development - Education & Training Foundation (et-foundation.co.uk)

T Level Associate Vacancies

There are a variety of contracted associate roles you may wish to apply as part of the T Level Qualifications such as-

- Moderators/ Principal Moderators
- Technical Qualification Associates (TQA's)
- Examiners and Assured Consultants

For further information, please contact

Samantha.ashman@cityandguilds.con or visit our website on the attached link- Associate Vacancies | City & Guilds Group

Careers

