Welcome to the T Level Engineering & Manufacturing

The webinar will begin shortly

November 2022

T-LEVELS | Institute for Apprenticeship & Technical Education

Engineering and Manufacturing T Level

A high-level overview of the Design & Development for Engineering and Manufacturing pathway

City & Guilds | eal

Using the webinar platform

Our action plan supports the planning and delivery stages to prepare for the TQ launch

Send any questions in the question area throughout the webinar

All attendees will be set to mute

Webinar resources will be shared on our website shortly after

Agenda

- Welcome
- Engineering & Manufacturing T Level
- Engineering & Manufacturing T Level pathways
  - Design and Development Occupational Specialisms
  - Specifications
  - Website navigations
  - Resources for Design & Development Pathway
  - TQ scheme of assessment
- **Employer Set Project D&D**
- **Design & Development – Mechanical**
  - Exemplar Occupational Specialism
- **Design & Development – Electrical & Electronics**
  - Exemplar Occupational Specialism
- **Design & Development – Control & Instrumentation**
  - Exemplar Occupational Specialism
- **Design & Development - Structural Engineering**
  - Exemplar Occupational Specialism
- How we support you
  - Support & Guidance
  - Events & Webinars?
  - Websites to support providers
  - Opportunities to work for City & Guilds
  - Engineering Text book from Hodder Education
- Opportunity for Questions

Engineering and Manufacturing T Level programme composition

T Level courses include the following compulsory elements:

A Technical Qualification, which includes:

- **core theory, concepts and skills for an industry area**
- **specialist skills and knowledge for an occupation or career**
- **an industry placement with an employer**

The T Level is a full-time two-year programme.

UCAS tariff points will be allocated and will be equivalent in value to three A Levels.

Students will also be required to work towards the attainment of maths and English if they have not already achieved grade 4 at GCSE, as they do on other 16 to 19 programmes.

Core

680 GLH / 1000 TQT

Graded	A* - E
Paper 1	Maths & Science
Paper 2	Engineering Concepts
ESP	Employer Set Project

Covers concepts and theories including core skills.

Occupational specialism

680 GLH / 1000 TQT

Graded Pass/merit/distinction
Based on occupational maps
Covers practical skills and knowledge in a specialist occupational area.

Assessment:

External set and marked exams and an employer set project.

Assessment:

Synoptic assignment covering practical skills and applied knowledge.

Industry Placement
315-420 hours
Min 45-60 days

Maths and English
GCSE or Functional Skills Level 2

(Continue to study as part of the condition of funding)

Tutorial- Employability enrichment, and pastoral hours

Technical Qualification overview for Engineering:

Engineering Core Component (8730)

Pathways:

- Design & Development for Engineering and Manufacturing (8714)
- Maintenance, Installation & Repair for Engineering and Manufacturing (8712)
- Engineering, Manufacturing, Processing and Control (8713)

Learners must complete:

- Engineering Core
- 1 Occupational specialism within a pathway

Route: Engineering and Manufacturing

PATHWAY -Design and Development for Engineering & Manufacturing (8730/8714)

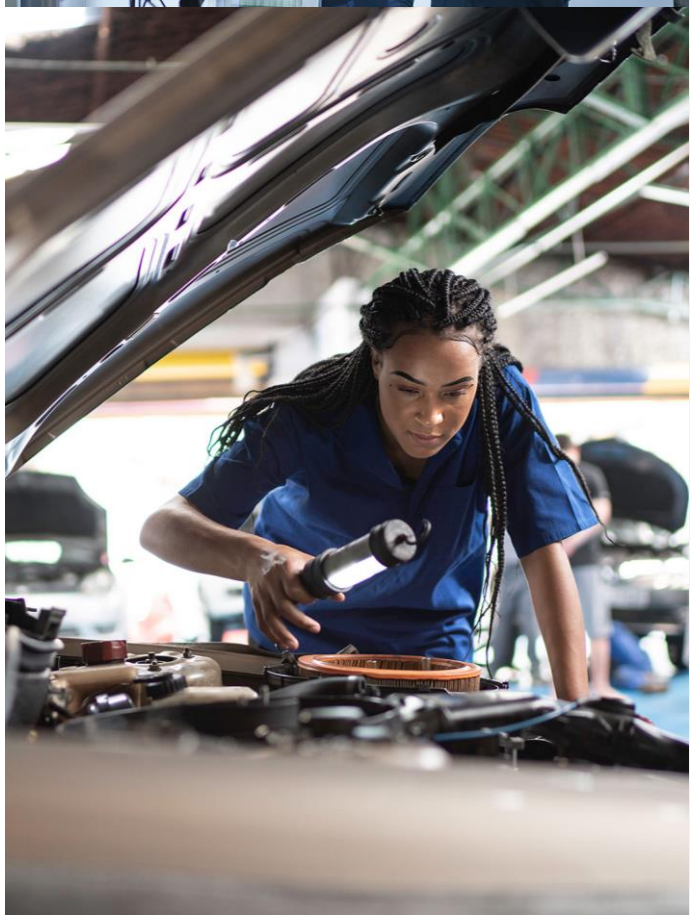
Occupational Specialisms

- Mechanical Engineering
  8714-31
- Electrical & Electronic Engineering
  8714-32
- Control & Instrumentation Engineering
  8714-33
- Structural Engineering
  8714-34

T Level Technical Qualifications

Design and Development for Engineering	
8730 – 14	**Core**
8714 – 31	Mechanical Engineering
8714 – 32	Electrical & Electronics Engineering
8714 – 33	Control & Instrumentation Engineering
8714 – 34	Structural Engineering

Registration information-
Core first before OS



Technical Qualification - Core

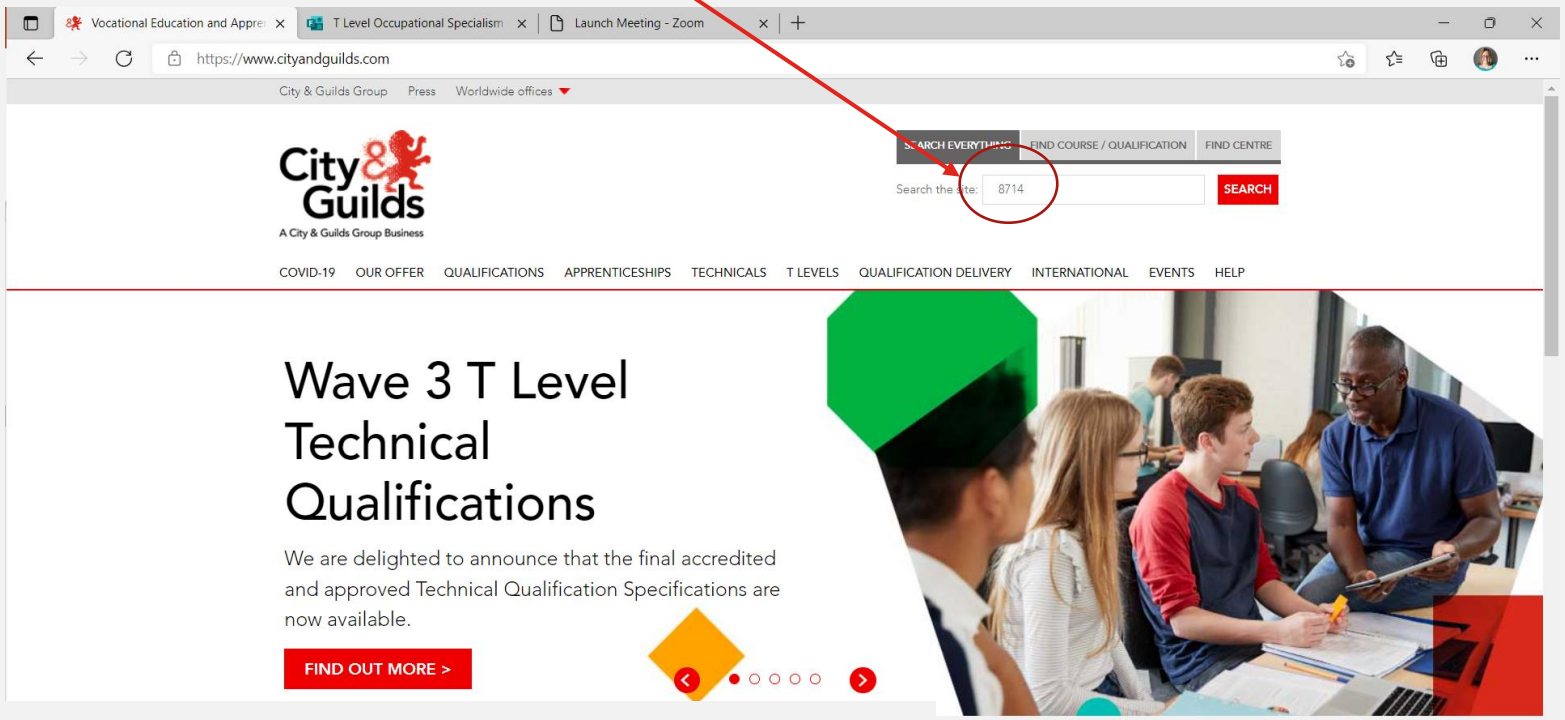
Element	Title	GLH
1	Working within the engineering and manufacturing sectors	30
2	Engineering and manufacturing past, present, and future	30
3	Engineering representations	40
4	Essential mathematics for engineering and manufacturing	90
5	Essential science for engineering and manufacturing	90
6	Materials 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

Specifications

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

Website Navigation

From the homepage you can search for the qualification 8714



Then select the qualification

T Level Technical Qualification in Design and Development for Engineering and Manufacturing (8714)

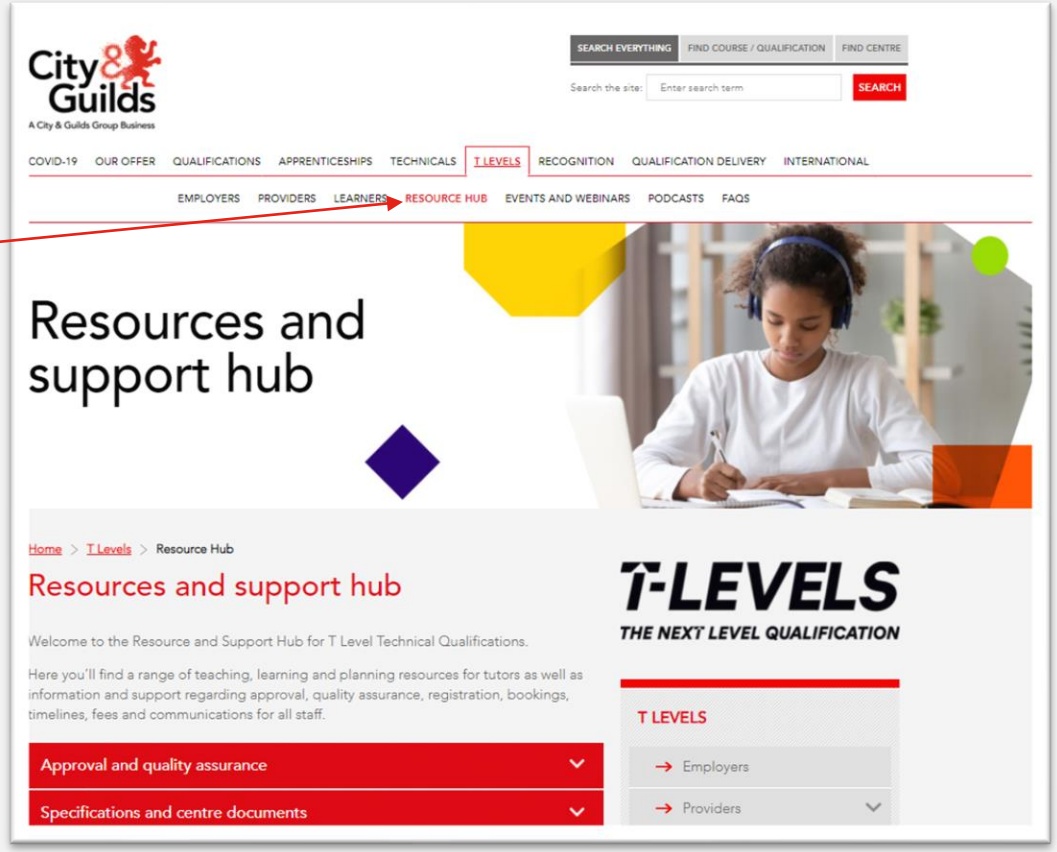
The T Level Technical Qualification in Design and Development for Engineering and Manufacturing allows learners to gain an understanding of what is needed to work within the engineering industry. Topics covered include customer and client requirements, principles of design, design process

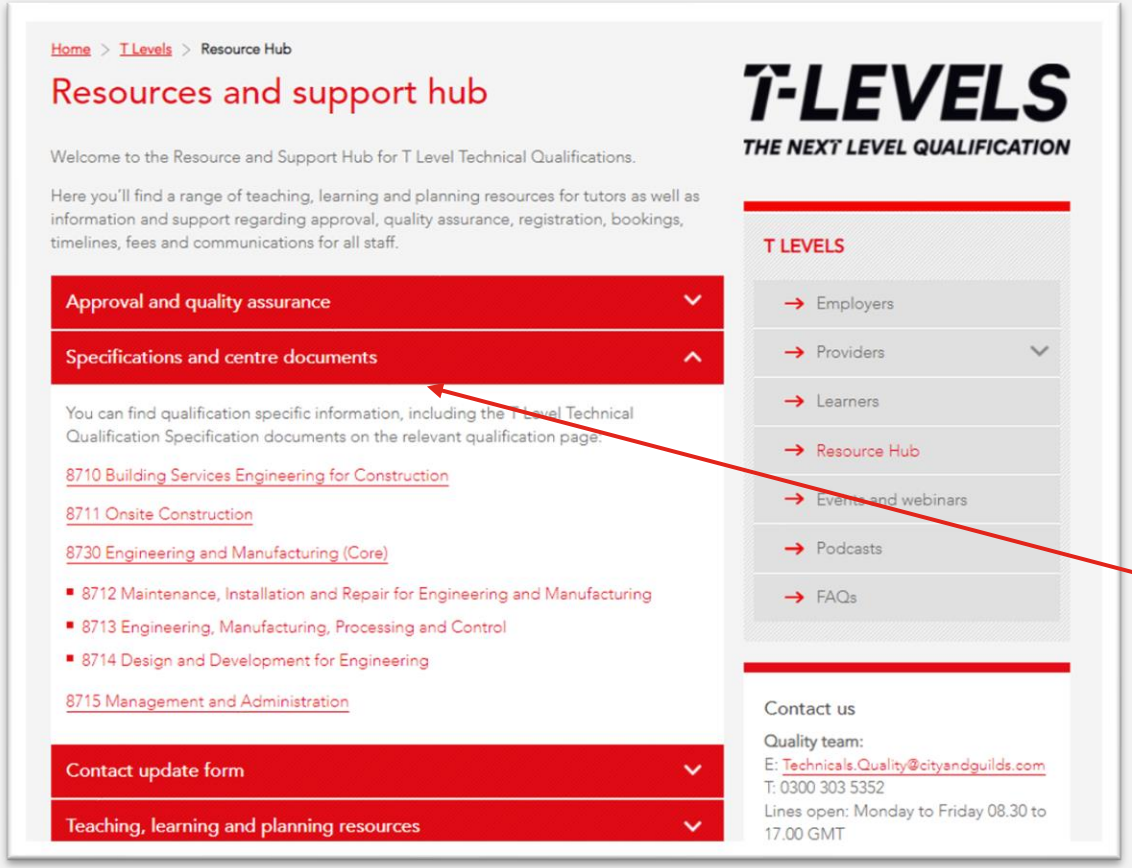
Level 3

News & Insight

Website Navigation

Or navigate through the C&G T Level Resource Hub webpage

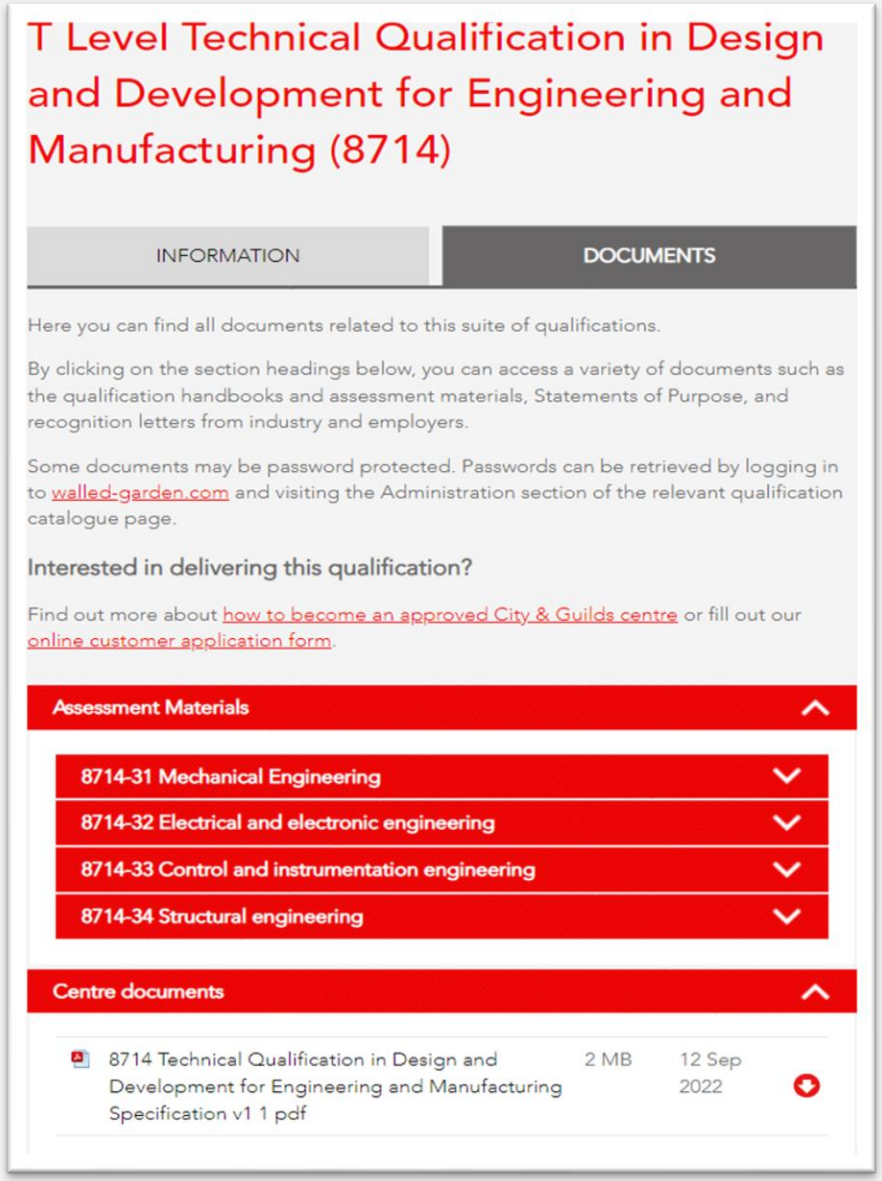




Then select specifications and centre documents

Website Navigation

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



Physical resources Occupational Specialisms

(page 13 onwards in specification)

Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessment.

Common resources

- Virtual modelling and CAD software.
- PPE.
- Scientific calculator.
- Manufacturer's instructions.
- Manufacturer's datasheets.
- Mechanical equipment (hand tools, portable power tools).
- Electrical / electronic equipment (hand tools, soldering irons).
- Measurement devices, instrumentation and gauges.

Mechanical engineering

- Materials and components.
- Tools - Screwdriver, hacksaw, hammer, files, Allen keys, spanner, socket set, wrench, glue gun, drill, pliers,
- Measurement equipment - measuring tapes, callipers, rules, laser scanning, micrometers, protractors, dial test indicators, digital stress and strain machines.

Electrical and electronic engineering

- PCB software
- Electronic components
- Circuit modelling methods
- DC power supply unit.
- Programmable logic controller (PLC) and microcontroller programming and simulation software. These could be text and/ or visual based programming.
- Tools - soldering irons, wire cutters, wire strippers, de-soldering tools, pliers, helping hands, drills (including PCB drills), screwdrivers, hand and power saws
- Measurement and testing equipment - multimeter, voltmeter, ohmmeter, ammeter, oscilloscope, spectrum analyser, signal generator, function generator, logic probe, logic pulser, logic analyser, insulation resistance tester, current tracer, frequency meter, AC bridge, virtual instruments.

Control and instrumentation engineering

- Materials, components and sensors - components and sub-assemblies (controllers, valves, sensors), configurations (PID, adaptive control), combinational and sequential logic and control systems.
- Tools - Screwdriver, wire cutters, wire strippers, soldering iron, hacksaw, hammer, files, Allen keys, spanner, socket set, wrench, crimping tools, heat gun, glue gun, drill, pliers (flat nose, needle nose, angle needle nose), rule, set square.
- Measurement and testing equipment - multimeter, signal generator, oscilloscope, logic probe, logic analyser, data logger, temperature gauge, flow meter, power meter.

Structural engineering

- Materials and components.
- Modelling materials.
- Testing and measurement equipment - compression and flexural testing machine, tensile testing machine, shear testing machine, Charpy test machine, venier structures and materials tester, load measurement, drying and weighing equipment, particle size analysis equipment, temperature measurement, measuring tapes, callipers, set squares, spirit level.
- Drill press.
- Lathe.
- Radial arm saw.
- Vice.
- Tools - hammer, saws, plyers, chisels, rasps and files, screwdrivers, hammers and mallets, hand planes, scissors and snips

Technical Qualification scheme of assessment overview– Design & Development Pathway (page 20 specification)

Core 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	This component will be awarded on the grade scale A* -E
Exam paper 2	Externally set exam	2.5 hours	100	35%	Externally marked	
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
Mechanical engineering	Externally set assignment	34 hours	90	100%	Externally moderated	All occupational specialism components will be awarded on the grade scale P,M,D
Electrical and electronic engineering	Externally set assignment	34 hours	90	100%	Externally moderated	
Control and instrumentation	Externally set assignment	34 hours	90	100%	Externally moderated	
Structural engineering	Externally set assignment	34 hours	90	100%	Externally moderated	

Technical Qualification – Employer Set Project

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

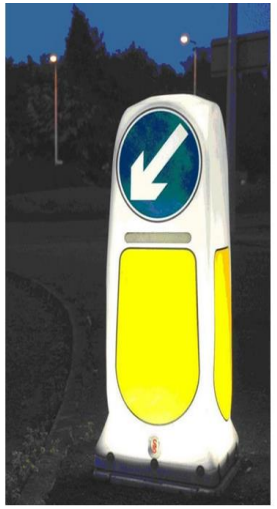
Exemplar Employer Set Project

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:

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

Where:

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)

∂b is the deformation of the bollard (in mm)

Photographs

Photograph 1: Typical area outside a Train Express Limited Station

(Source of image: Shutterstock)

Technical Qualification - Design and Development for Engineering & Manufacturing

Occupational Specialism – Practical Assignments

Occupational Specialism Assessment – Practical assignments

Each occupational specialism assessment will comprise of a practical assignment that.

- Contains **90 marks**
- Set duration of **34 hours**
- **Externally set, Internally marked**
- **Externally moderated** by City & Guilds
- is based on an overarching project brief
- Range of individual tasks that are mapped to the performance outcomes of the specialism; with weightings applied per performance outcome.
- Mark scheme that reflects the individual performance outcome assessed by the specialism and with banded marks to reflect the assigned weightings.

Performance Outcomes

- The weightings for each performance outcome will remain the same for every version of the practical assignment. This ensures the appropriate depth and breadth of knowledge and skills for each specialism can be reliably assessed in every version and meets the needs of industry while keeping comparability between each assessment over time.
- Same performance outcomes across all occupational specialisms

Performance outcome	Typical knowledge and skills	Weighting
PO2 Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications.	Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications.	16%
PO3 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.	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.	22%
PO4 Propose and design mechanical engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context.	Design and model mechanical concepts, and designs. Use CAD software to produce models, simulations and engineering drawings. Use tools safely and effectively for specific purposes. Safely carry out engineering processes and activities.	23%
PO4 Collaborate to help manage, develop, test and quality assure mechanical engineering and manufacturing design information, systems, processes and outcomes.	Work in accordance with professional standards, work-place policies, health and safety requirements and regulations. Complete detailed risk analysis. Respond to feedback from others to inform design decisions. Develop and test models and prototypes. Investigate and analyse test results and accurately report and respond to them.	26%
PO5 Communicate proposals, design information and solutions, producing, recording and explaining engineering and manufacturing representations, systems, processes, outcomes, specifications and technical drawings.	Use methods to communicate proposals, design ideas and solutions. Produce technical documentation using industry conventions.	13%

Technical Qualification - Design and Development for Engineering & Manufacturing

Occupational Specialism – Mechanical Engineering

DD Mechanical Engineering (page 29 onwards in specification)

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.

Component	Assessment method	Overview and conditions
Mechanical engineering	Externally set, externally moderated	**Content overview** 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

Specification – Mechanical Engineering (page 71 onwards)

Underpinning knowledge outcomes

On completion of this specialism, learners will understand:

1. Mechanical engineering knowledge criteria

Performance Outcomes

On completion of this specialism, learners will be able to:

2. Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications.
3. 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.
4. Propose and design mechanical engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context.
5. Collaborate to help manage, develop, test and quality assure mechanical engineering and manufacturing design information, systems, processes and outcomes.
6. Communicate proposals, design information and solutions, producing, recording and explaining engineering and manufacturing representations, systems, processes, outcomes, specifications and technical drawings.

Completion of this specialism will give learners the opportunity to develop their Maths, English and Digital Skills. Details are presented at the end of the specification.

321 Mechanical engineering

Level:	3
GLH:	680
Assessment method:	Practical assignment

What is this specialism about?

The purpose of this specialism is for learners to know and undertake designing and development processes within mechanical engineering.

Learners will have the opportunity to plan, perform and evaluate their work whilst utilising a range of techniques, methods and resources.

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

- Knowledge of design methodologies and processes.
- Knowledge of the tools, equipment and materials used in mechanical engineering.
- Knowledge of mathematical theories and methods used in mechanical engineering.
- Skills in producing mechanical drawings and representations.
- Skills in designing and developing working models.
- Skills in testing models and prototypes.

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

- What different types of mechanical systems are there and what are they used for?
- What do mechanical engineers do on a daily basis?
- What areas of the engineering industry do mechanical engineers work in?

Specification – Mechanical Engineering - Knowledge (page 73 onwards)

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.

Specialism content

Outcome 1

Common knowledge criteria

Mechanical engineering knowledge criteria

1.1 **Principles** of engineering design in mechanical engineering

Range:
Principles – Requirements (functionality, aesthetics, dimensions, ergonomics, safety, sustainability, cost, materials), methods of identifying requirements (market research, client interviews, client observation, product analysis), methods of recording requirements (design brief, specification, questionnaire/survey forms, observational records), factors that affect design (product life cycles, sustainability (recycling and re-use), safety), fields within mechanical engineering (design, manufacture and processing, fitting and assembly maintenance), methods of communicating designs (orthographic drawings, virtual models, physical models).

What do learners need to learn?	Skills
How to agree the nature and scope of mechanical engineering projects.	EC1
How to identify, interpret and confirm client and customer requirements, proposals, ideas, objectives and aspirations.	
How to record client and customer requirements, and the implications of not doing so accurately or effectively.	
How to evaluate and develop client and customer requirements.	
Design requirements unique to fields within mechanical engineering, and the factors that affect them.	
How to communicate design ideas (proposals, solutions, processes, concepts) and technical information relating to mechanical engineering.	
The different tools for recording, evaluating and developing client and customer requirements.	
How to evaluate, develop, challenge, and refine ideas, proposals, and objectives.	

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.

Specification – Mechanical Engineering – Practical Skills
(page 81 onwards)

Practical criteria for Performance Outcomes

Outcome 2

2. Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications

2.1 Access, interpret and respond to mechanical design projects and tasks and requirements from different **sources.**

Range:
Sources – Design briefs, specifications, concept drawings, stakeholders (supervisors, colleagues, client/end user).

What do learners need to demonstrate?	Skills
Follow processes to access, examine, interpret, review and respond to information on mechanical engineering projects and tasks from different sources.	EC1 EC5 EC6

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"

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

What do learners need to demonstrate?
The primary purpose of these sections is to support the practical skills 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 and demonstrated through practical skills.

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

OS Exemplar Assessment - 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 manually-powered 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, the surface of which is at the same height as the lifting platform. It is then pulled by a human worker onto the flat lifting 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.

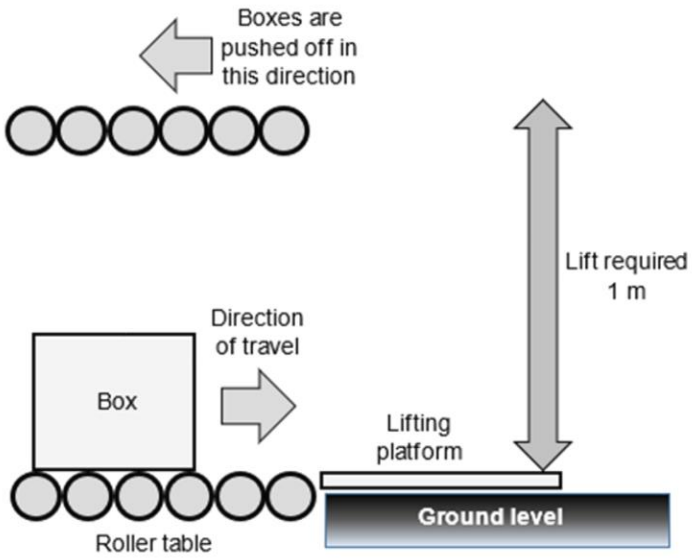


Figure 1

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
- the lifting device must be assembled as a permanent product.

Time

The time allocated for the completion of the tasks and production of evidence for this assessment is 34 hours. Timings for completion of specific tasks are outlined below.

- Task 1 – 14 hours
- Task 2 – 13 hours
- Task 3 – 1 hour
- Task 4 – 6 hours

When working under supervised conditions for longer sessions, breaks can be facilitated outside of the controlled conditions, ensuring the room is locked and all candidates have vacated once the break begins. All materials must be kept securely during the break.

OS Exemplar Assessment - Mechanical

Task 1 – Design

Candidates must:

a) produce a detailed design specification that builds on the design criteria for the lifting device, including references to any research used

b) sketch and annotate up to 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.

Task 2 – Manufacture and test

Candidates must:

a) produce a risk assessment for the manufacture of the prototype.

b) manufacture the prototype.

c) test the operation of the prototype.

The prototype can be full size or a scale model (the minimum acceptable size is 1:5 scale).

Task 3 – Peer review

As part of the development and design process it is critical that engineers can work constructively with others and consider feedback to inform designs to ensure they meet their purpose and requirements.

The assessor will set up the groups and make sure that candidates have access to copies of their design. The candidate being assessed will present their design.

a) Prepare to present their design verbally using annotated sketches and diagrams.

b) Present and explain the design.

c) Peer reviewers will now have time to reflect on the design.

d) Discuss feedback from the group on the design presented in part b).

e) Peer reviewers will now complete the peer review feedback form.

Task 4 – Evaluation and implementation

Candidates must:

a) produce a virtual model of the design using appropriate software incorporating any changes they have decided to make in response to feedback or as a result of manufacturing and testing

b) produce a revision control document/report that is typically 500 words justifying why changes were made or not made as a result of the peer review feedback

c) produce a report evaluating the proposed design. The report should typically be 800 words. This must include:

- the information necessary for a third party to implement the model, including health and safety considerations
- calculations of the operating efficiency of the lifting device
- an explanation of the test methods used, reasons for their use and their limitations
- an evaluation of the fitness for purpose of the lifting device and its conformance to the specification
- any improvements or adaptions required to the model, including any reasoning and justifications if adaptions or improvements are not required.

OS Exemplar Assessment – Mechanical – Marking Grid

Assessment theme – Design and Planning

Guidance for assessors

The following evidence from Task 1 should be used to assess performance against this assessment theme.

Task 1

- design specification
- up to three annotated sketches
- justification of the choice of one design for further development
- justification of the selection of the materials and components
- design calculations
- bill of materials
- engineering drawings of the design proposal
- outcomes of the virtual modelling of the proposed design, either as screen captures or printouts.

Task 4

- outcomes of virtual modelling

	Virtual modelling • use of virtual modelling tools/ CAD to prepare a virtual model of the lifting device • use virtual model to simulate function of mechanical systems and components, such as pulleys, gears, levers and/or linkages used to lift the mass to the required height.				
Marks per band	**1-4**	**5-8**	**19-12**	**12**	**33**
Documents	Specification is brief with minor inaccuracies in technical knowledge. Most points have been analysed, considered and elaborated on. Some key materials and quantities to meet the brief have been identified. No reasoning provided to justify choices made for selection of materials. Some design calculations and methodology applied are accurate.	Specification is clear with minor inaccuracies in technical knowledge. All points have been analysed, considered and most have been elaborated on. Most key materials, quantities required to meet the brief have been identified. Some reasoning provided to justify choices made for selection of materials. Most design calculations and methodology applied are accurate.	Specification is detailed and thorough with accurate technical knowledge throughout. All points have been analysed, considered and elaborated on. All materials and quantities required to meet the brief have been identified. Clear and detailed reasoning provided to justify choices made for selection of materials. All design calculations and methodology applied are accurate with reference to industry standards annotated.		

Note: where there is insufficient evidence to award a mark, a zero mark must be given	**Band 1 descriptor**	**Band 2 descriptor**	**Band 3 descriptor**	**Total marks per sub assessment themes.**	**Total marks for assessment theme**
	Indicative content: **Documents** • analysis and interpretation of design criteria • the appropriate selection of materials, standard parts, mechanical components assemblies and sub-assemblies, tools and equipment • materials and standard parts: Appropriate metals (e.g. aluminium, carbon steel), thermosetting and/or thermoplastic polymers, composite materials, supports and fittings to ensure a solid structure for the lifting device • mechanical components, assemblies and sub-assemblies: pulley systems, linkages, levers, gears (e.g. rack and pinion) • the type, size and quantity of materials required to complete the tasks in order to ensure the highest quality of finish • permanent assembly and joining methods e.g. welding, adhesives, rivets • design calculations e.g. calculate mechanical advantage, efficiency, gear and velocity ratios • scientific principles e.g Newton's Laws, properties of materials, efficiency, friction. **Drawings and diagrams** • engineering diagrams and representations (sketches, orthographic drawings, general arrangement and assembly drawings) • sketches include annotations and notes to show how each design will meet the functional requirements of the brief, e.g. lifting the 25 kg mass to a height of 1 m • orthographic drawings include information required to make the prototype, including tolerances and dimensions of the lifting system and all mechanical assemblies and sub-assemblies • GA drawings clearly communicate the relationship between all mechanical devices, assemblies and sub-assemblies used in the lifting system, such as pulley systems, gears, levers and/or linkages. Candidates will not be penalised if they do not hand in three designs but should be marked on the quality of what is produced. Three designs are instructed in the task as an optimal number to allow candidates to show the depth and breadth of their knowledge and understanding in response to a brief.				

Technical Qualification - Design and Development for Engineering & Manufacturing

Occupational Specialism – Electrical & Electronics Engineering

DD Electrical & Electronics Engineering (page 29 onwards in specification)

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.

Component	Assessment method	Overview and conditions
Electrical and electronic engineering	Externally set, externally moderated	**Content overview** 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 electrical and electronic engineering and manufacturing proposals and solutions. • Propose and design electrical and electronic engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context. • Collaborate to help manage, develop, test and quality assure electrical and electronic 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

Specification – Electrical & Electronics Engineering (page 96 onwards)

Knowledge (page 98 onwards)

Practical Skills (page 106 onwards)

Underpinning knowledge outcomes

On completion of this specialism, learners will understand:

1. Electrical and electronic engineering knowledge criteria

Performance Outcomes

On completion of this specialism, learners will be able to:

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

Completion of this specialism will give learners the opportunity to develop their Maths, English and Digital Skills. Details are presented at the end of the specification.

322 **Electrical and electronic engineering**

Level:	3
GLH:	680
Assessment method	Practical assignment

What is this specialism about?

The purpose of this specialism is for learners to know and undertake designing and development processes within electrical and electronic engineering.

Learners will have the opportunity to plan, perform and evaluate their work whilst utilising a range of techniques, methods and resources.

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

- Knowledge of design methodologies and processes.
- Knowledge of the tools, equipment and materials used in electrical and electronic engineering.
- Knowledge of representations, symbols, conventions, and annotations used in electrical and electronic engineering.
- Skills in producing electrical and electronic drawings and representations.
- Skills in designing and developing working models.
- Skills in testing models and prototypes.

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

- What different types of electrical and electronic systems are there and what are they used for?
- What do control and electrical and electronic engineers do on a daily basis?
- What areas of the engineering industry do electrical and electronic engineers work in?

OS Exemplar Assessment – Electrical & Electronic Engineering

2. Assignment brief

You are an electrical engineer employed by a company that sells a variety of products online. The company operates from large warehouses, each storing a range of products. When an order is received, human workers put the items in boxes and place the boxes on a conveyor belt to the despatch area. Depending upon the size of each box, it is then allocated to one of two couriers who will deliver it.

Due to a growth in sales, the company wants to automate the sorting activity in the despatch area. You have been asked to design, build and test a prototype for a circuit that will sort and allocate the boxes.

Figure 1 shows a plan view of the despatch area.

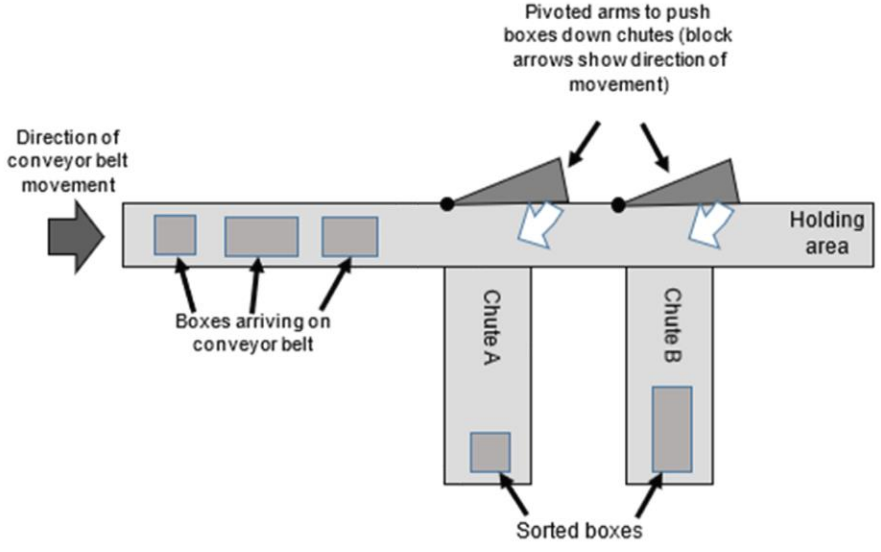


Figure 1

The boxes will arrive on a conveyor belt that travels at a constant speed.

All boxes are cuboid in shape, with a standard width of 250 mm.

If the box is less than 200 mm high and 300 mm long, it must be directed down chute A. If it is larger than these sizes, it must be directed down chute B. The required accuracy of the device must be within a tolerance of 10% of the parameters stated here.

The boxes are directed down the chutes by pivoted arms. These are powered by servo motors.

If, for some reason, a box passes the chutes and arrives in the holding area a warning light and buzzer must activate, to alert human operators that attention is needed.

Design Criteria

The design criteria for this application are:

- the circuitry must detect when the height of a box is less than 200 mm
- the circuitry must detect when the length of a box is more than 300 mm
- the required accuracy of detection is within tolerance of 10% tolerance of the parameters stated
- the maximum weight of the box is 2 kg
- if the box is less than 200 mm high and 300 mm long, it must be directed down chute A. If it is larger than these sizes, it must be directed down chute B
- the inputs to the circuitry must include:
  - a method to turn the system on and off
  - appropriate sensors to detect the required dimensions
  - a sensor to detect when a product reaches the holding area
- the outputs from the circuitry must include:
  - a visual indicator (light) to indicate when a product should be directed down chute A
  - a visual indicator (light) to indicate when a product should be directed down chute B
  - appropriate output signals to operate the servo motors for the pivot arms, to both direct the boxes down the chute and to return to the start position as appropriate for the next box
  - a visual indicator (light) and audible output to indicate when a product is in the holding area
- the input and output devices should be connected to the circuitry.

Time

The time allocated for the completion of the tasks and production of evidence for this assessment is 34 hours. Timings for completion of specific tasks are outlined below.

- Task 1 – 14 hours
- Task 2 – 13 hours
- Task 3 – 1 hour
- Task 4 – 6 hours

When working under supervised conditions for longer sessions, breaks can be facilitated outside of the controlled conditions, ensuring the room is locked and all candidates have vacated once the break begins. All materials must be kept securely during the break.

OS Exemplar Assessment – Electrical & Electronic Engineering

Task 1 – Design

Candidates must:

a) produce a design specification that builds on the design criteria for the circuitry, including any references to research used

b) generate a suitable design for the circuitry, including:

- selection of appropriate sensors with justifications
- calculations of the values required for successful operation, including the power required by the circuitry and the motors, timings and values for at least two different types of component
- configuration of the circuitry including a circuit diagram and wiring diagram
- printed circuitry board (PCB) layout for the circuitry

c) simulate the performance of the proposed design using CAD software

d) assemble a physical model of the circuitry and test its operation

e) produce a bill of materials (BoM) listing all of the parts required in the final design proposal.

Task 2 – Manufacture and test

Candidates must:

a) produce risk assessments for the production of the PCB and the construction of the soldered prototype

b) produce the PCB for the design

c) build a soldered prototype working circuitry from your design

d) test the operation of the circuitry.

Task 3 – Peer review

As part of the development and design process it is critical that engineers can work constructively with others and consider feedback to inform designs to ensure they meet their purpose and requirements.

The assessor will set up the groups and make sure that candidates have access to copies of their design. The candidate being assessed will present their design.

a) Prepare to present their design verbally using annotated sketches and diagrams.

b) Present and explain the design.

c) Peer reviewers will now have time to reflect on the design.

d) Discuss feedback from the group on the design presented in part b).

e) Peer reviewers will now complete the peer review feedback form.

Task 4 – Evaluation and implementation

Candidates must:

a) produce a virtual model of the design using appropriate software incorporating any changes they have decided to make in response to feedback or as a result of manufacturing and testing

b) produce a revision control document/report that is typically 500 words justifying why changes were made or not made as a result of the peer review feedback

c) produce a report evaluating the proposed design. The report should typically be 800 words. This must include:

- an explanation of the test methods used, reasons for their use and their limitations
- a summary of the capabilities of the circuitry
- an evaluation of the fitness for purpose of the design proposal and its conformance to the design criteria and specification
- the information necessary for a third party to implement the prototype
- an outline of any additional factors that may need to be considered during the implementation, including:
  - cable types to be used to connect the sensors to the circuitry, if appropriate
  - health and safety considerations
  - applicable requirements from wiring regulations
- any improvements or adaptions required to the prototype, including any reasoning and justifications if adaptions or improvements are not required.

Technical Qualification - Design and Development for Engineering & Manufacturing

Occupational Specialism – Control & Instrumentation Engineering

DD Control & Instrumentation Engineering (page 29 onwards in specification)

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.

Component	Assessment method	Overview and conditions
Control and instrumentation engineering	Externally set, externally moderated	**Content overview** Learners will be able to: • Analyse and interpret control and instrumentation 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 control and instrumentation-related engineering and manufacturing proposals and solutions. • Propose and design control and instrumentation-related engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context. • Collaborate to help manage, develop, test and quality assure control and instrumentation related 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, design specifications and technical drawings. **Assessment overview:** Learners will be assessed against the following assessment themes: • Health and safety • Design and planning • Manufacturing • Reports

Specification – Control & Instrumentation (page 120 onwards)

Knowledge (page 122 onwards)

Practical Skills (page 129 onwards)

Underpinning knowledge outcomes

On completion of this specialism, learners will understand:

1. Control and instrumentation engineering knowledge criteria.

Performance Outcomes

On completion of this specialism, learners will be able to:

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

Completion of this specialism will give learners the opportunity to develop their Maths, English and Digital Skills. Details are presented at the end of the specification.

323 Control and instrumentation engineering

Level:	3
GLH:	680
Assessment method:	Practical assignment

What is this specialism about?

The purpose of this specialism is for learners to know and undertake designing and development processes within Control and Instrumentation.

Learners will have the opportunity to plan, perform and evaluate their work whilst utilising a range of techniques, methods and resources.

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

- Knowledge of instrumentation and control systems used in process control.
- Knowledge of the process control systems and controllers.
- Knowledge of basic features and configurations of control systems.
- Skills in the process of tuning techniques.
- Skills in design process for a process control system.

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

- What differences are there in the control systems found on modern motor vehicles, aircrafts and robots?
- What different types of control systems are there and what are they used to control?
- What do control and instrumentation engineers do on a daily basis?
- What areas of the engineering industry do control and instrumentation engineers work in?

OS Exemplar Assessment – Control & Instrumentation

2. Assignment brief

You are a control and instrumentation engineer employed by an industrial food production company that supplies its products to supermarkets. The company grows food bearing plants in large indoor facilities, such as that shown in Figure 1.

In order to grow properly, the plants must be provided with enough artificial light and be kept at the correct temperature at all times. If this does not happen, the resulting products will not meet the needs of the customer and will have to be thrown away.

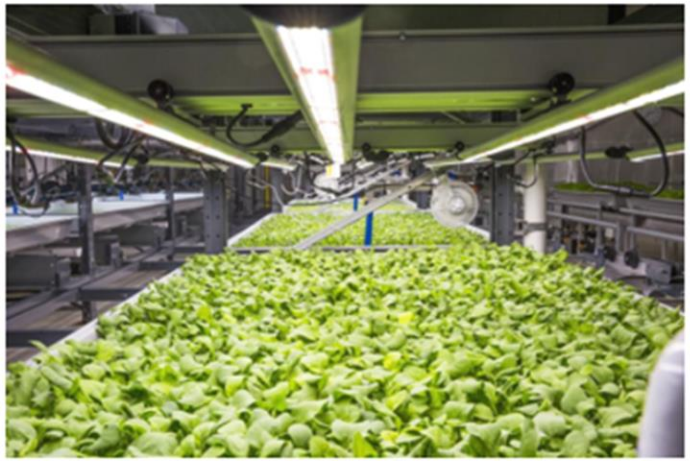


Figure 1

https://www.forbes.com/sites/erikkobayashisolomon/2019/04/05/investing-in-vertical-farming-five-take-aways/?sh=318590b3355c

You have been asked to design, develop and test a prototype for a control system that will maintain the correct lighting and temperature levels for one of the company's facilities. If the design is successful, it will be used across all of the company's food growing facilities.

The system must meet the needs of the design criteria given below as a minimum requirement.

Design Criteria

The design criteria for this application are:

- the system must be stable and capable of automatically regulating a temperature within a range of 18°C – 24°C
- the temperature control system must not exceed three overshoots on first switching on from a 30°C start
- a pre alarm must sound when the temperature is nearing the range limits
- the system must provide a visual output showing the temperature and light level measurements in real time
- the system must be able to record parameters relevant to its operation
- the system must be able to change the desired temperature range and light level to suit different produce
- the system must be able to detect when the light level, above the produce, is below 100000 lux.

Time

The time allocated for the completion of the tasks and production of evidence for this assessment is 34 hours. Timings for completion of specific tasks are outlined below.

- Task 1 – 14 hours
- Task 2 – 13 hours
- Task 3 – 1 hour
- Task 4 – 6 hours

When working under supervised conditions for longer sessions, breaks can be facilitated outside of the controlled conditions, ensuring the room is locked and all candidates have vacated once the break begins. All materials must be kept securely during the break.

OS Exemplar Assessment – Control & Instrumentation

Task 1 – Design

Candidates must:

a) produce a detailed design specification that builds on the design criteria given in the assignment brief, including any references to research used. The specification should include:
   - a definition of the operating limits of the system
   - an analysis of how system stability will be achieved.

b) generate a suitable design for the control system, including:
   - annotated sketches, block and wiring diagrams for the system that show how it will function
   - selection of appropriate sensors with justifications, and all relevant calculations
   - selection of appropriate pre alarm temperatures with justifications and all relevant calculations.

     (The exact position of the pre alarm range limits will be determined by the design of your system).

c) produce a virtual model of the proposed design using appropriate software

d) create a bill of materials (BoM) listing all of the parts required in their final design proposal.

Task 2 – Manufacture and test

Candidates must:

a) produce a risk assessment for the construction of the prototype

b) use a permanent construction method to produce the prototype

c) test and verify the operation of the completed prototype.

Task 3 – Peer review

As part of the development and design process it is critical that engineers can work constructively with others and consider feedback to inform designs to ensure they meet their purpose and requirements.

The assessor will set up the groups and make sure that candidates have access to copies of their design. The candidate being assessed will present their design.

a) Prepare to present their design verbally using annotated sketches and diagrams.

b) Present and explain the design.

c) Peer reviewers will now have time to reflect on the design.

d) Discuss feedback from the group on the design presented in part b).

e) Peer reviewers will now complete the peer review feedback form.

Task 4 – Evaluation and implementation

Candidates must:

a) produce a virtual model of the design using appropriate software incorporating any changes they have decided to make in response to feedback or as a result of manufacturing and testing

b) produce a revision control document/report that is typically 500 words justifying why changes were made or not made as a result of the peer review feedback

c) produce a report evaluating the proposed design. The report should typically be 800 words. This must include:
   - an explanation of the test methods used, reasons for their use and their limitations
   - an evaluation of the fitness for purpose of the design proposal and its conformance to the design criteria and specification
   - the information necessary for a third party to implement their design, including commissioning procedures and health and safety considerations
   - any improvements or adaptations to the design including any reasoning, and justifications if adaptions or improvements are not required.

Technical Qualification - Design and Development for Engineering & Manufacturing

Occupational Specialism – Structural Engineering

DD Structural Engineering (page 29 onwards in specification)

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.

Component	Assessment method	Overview and conditions
Structural engineering	Externally set, externally moderated	**Content overview** 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 structural engineering, manufacturing and construction proposals and solutions. • Propose and design structural engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context. • Collaborate to help manage, develop, test and quality assure structural 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

Specification – Structural Engineering (page 143 onwards)

Knowledge (page 145 onwards)

Practical Skills (page 154 onwards)

Underpinning knowledge outcomes

On completion of this specialism, learners will understand:

1. Structural engineering knowledge criteria.

Performance Outcomes

On completion of this specialism, learners will be able to:

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

Completion of this specialism will give learners the opportunity to develop their Maths, English and Digital Skills. Details are presented at the end of the specification.

324 Structural engineering

Level:	3
GLH:	680
Assessment method:	Practical assignment

What is this specialism about?

The purpose of this specialism is for learners to know and undertake fundamental structural engineering work. Learners will have the opportunity to plan, perform and evaluate their work whilst utilising a range of techniques, methods and resources.

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

- Knowledge of methods used to analyse the loads and forces applied to simple structures.
- Knowledge of approaches used to design elements, components and assemblies for simple structures.
- Knowledge of how structural materials degrade and fail.
- Skills for the presentation of structural engineering 2D and 3D drawings and documentations.
- Skills for the interpretation of briefs and project constraints to develop structural concepts for different scenarios.
- Skills in the design, development and testing of prototypes and models.

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

- What forces and loads impact buildings and structures during and after construction?
- What types of materials are used when constructing different parts of buildings?
- What types of projects require structural engineering designs to be developed?

OS Exemplar Assessment – Structural Engineering

2. Assignment brief

The electricity pylons that grace the UK skyline have their origins in a design submitted to the then Central Electricity Board by the Milliken Brothers in 1928 (refer to Figure 1 below).

Figure 1: The Milliken Brother's Icon Pylon (source https://www.gorge.org/pylons/structure.shtml)

The design of the electric pylon has reflected this iconic, four-sided trussed structure for over 90 years.

Many of these pylons are coming to the end of their useful design lives, despite regular maintenance schedules. As a consequence, a new progressive electrical company wants to introduce a more modern pylon which is less obvious on the skyline, and will have less of a visual impact. They have launched a design competition for the new pylon.

You are working as a structural engineer at an engineering company. Your company has entered the competition and you have been asked to design a pylon to be entered into the competition.

Design Criteria

The design criteria for this application are:

- the pylon must have two 4m cross arms to support electric power lines
- the pylon must have an overall height of 36m
- the pylon must support an imposed load of 600kN for electrical catenary and wires at the end of each cross arm
- the pylon must be less visually intrusive on the skyline
- the pylon must be resilient in all weather conditions
- the pylon must be aesthetically acceptable in both urban and natural environments
- the pylon must have limited operational maintenance
- the pylon must have reduced vulnerability to lightning strike
- the pylon must be sustainable and easily repurposed at the end of life
- the pylon must be easily installed by a mobile crane.

Time

The time allocated for the completion of the tasks and production of evidence for this assessment is 34 hours. Timings for completion of specific tasks are outlined below.

- Task 1 – 14 hours
- Task 2 – 13 hours
- Task 3 – 1 hour
- Task 4 – 6 hours

When working under supervised conditions for longer sessions, breaks can be facilitated outside of the controlled conditions, ensuring the room is locked and all candidates have vacated once the break begins. All materials must be kept securely during the break.

OS Exemplar Assessment – Structural Engineering

Task 1 – Design

Candidates must:

a) produce a detailed design specification that builds on the design criteria for the full-size pylon, including any references to research used

b) sketch and annotate up to three potential designs for the pylon

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 concept calculations justifying the initial member size of the body and cross arms of the pylon

f) create engineering drawings of the proposed design using CAD software

g) produce a virtual model of the proposed design using CAD software to illustrate the form of the pylon, construction sequence and the suitability of its setting in a rural and urban landscape

h) create a bill of materials (BoM) listing all of the parts required in your final design proposal.

Task 2 – Manufacture and test

Candidates must:

a) produce a risk assessment for the manufacture of the scaled prototype

b) construct a scaled prototype to be used in testing of the main body of the pylon

c) carry out global stability testing for the scaled prototype pylon checking its suitability of carrying the required scaled loading

d) select and carry out material strength testing for a full-scale sample of the body of the main pylon.

Task 3 – Peer review

As part of the development and design process it is critical that engineers can work constructively with others and consider feedback to inform designs to ensure they meet their purpose and requirements.

The assessor will set up the groups and make sure that candidates have access to copies of their design. The candidate being assessed will present their design.

a) Prepare to present their design verbally using annotated sketches and diagrams.

b) Present and explain the design.

c) Peer reviewers will now have time to reflect on the design.

d) Discuss feedback from the group on the design presented in part b).

e) Peer reviewers will now complete the peer review feedback form.

Task 4 – Evaluation and implementation

Candidates must:

a) produce a virtual model of the design using appropriate software incorporating any changes they have decided to make in response to feedback or as a result of manufacturing and testing

b) produce a revision control document/report that is typically 500 words justifying why changes were made or not made as a result of the peer review feedback

c) produce a report evaluating the proposed design. The report should typically be 800 words. This must include:

- the information necessary for a third party to implement the prototype including health and safety considerations
- an explanation of the test methods used, reasons for their use and their limitations in relation to their scaled prototype
- an evaluation of the fitness for purpose of the prototype and its conformance to the specification
- any improvements or adaptions required to the prototype, including any reasoning and justifications if adaptions or improvements are not required.

How we support you

Updates/Topics/Networks

Blended approach to communication

Provider networks and events

e-bulletin content and email updates

Website

Support and Guidance

Ready to support eligible providers and stakeholder engagement

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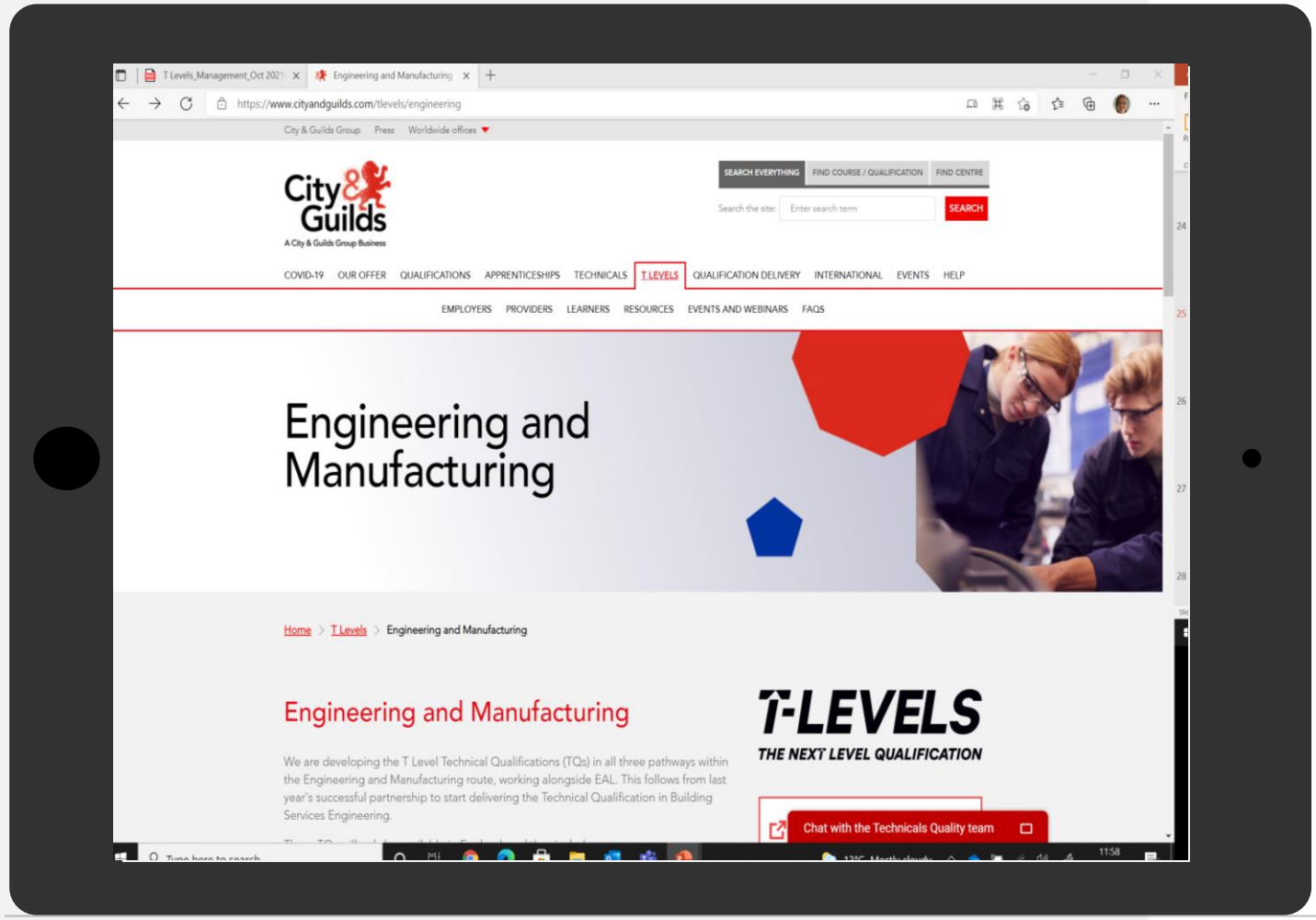
- Provider focus groups
- Employer Industry Boards
- e-bulletins
- Specification
- Resource Hub https://www.cityandguilds.com/tlevels/resources
- Learner flyer t-levels-learner-flyer-engineering-and-manufacturing
- Dedicated Technical Advisors



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

Events & Webinars

- Resource development for the core
- Teaching & Learning support for exam component
- Face-to-face events
- Events, networks and webinars are located on our T Level Home page here under the accordion Engineering & Manufacturing. Here you will also find copies of the slide decks presented in the events, networks and webinars.
- Recorded webinars on our dedicated Engineering Go To Webinar Channel here.
- For the most up to date information regarding future events please register for our T Level e-bulleting at the bottom of this webpage, here.
- (**16.11.22,** 14.45-15.45 GMT) Network event (recorded) T Level D & D familiarisation
- (**17.11.22,** 14.45-15.45 GMT) Network event (recorded) T Level familiarisation MIR for Engineering & Manufacturing
- (**18.11.22,** 14.45-15.45 GMT) Network event (recorded) T Level familiarisation MPC for Engineering & Manufacturing
- (**18.01.23,** 14.45-15.45 GMT) Network event (recorded) Curriculum Plan & delivery models

Websites to Support Providers

T Level Industry Placement Delivery Guidance
T Level industry placements delivery guidance - GOV.UK (www.gov.uk)

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

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

T Levels capital fund
T Levels capital fund - GOV.UK (www.gov.uk)

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

T Levels: next steps for providers
T Levels: next steps for providers - GOV.UK (www.gov.uk)

Supporting with delivering T Levels
Support with delivering T Levels

T Level Transition Programme Framework for 2022 – 2023
T Level Transition Programme Framework for Delivery 2022 to 2023 - GOV.UK (www.gov.uk)

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

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Engineering and Manufacturing T Level: Core Textbook

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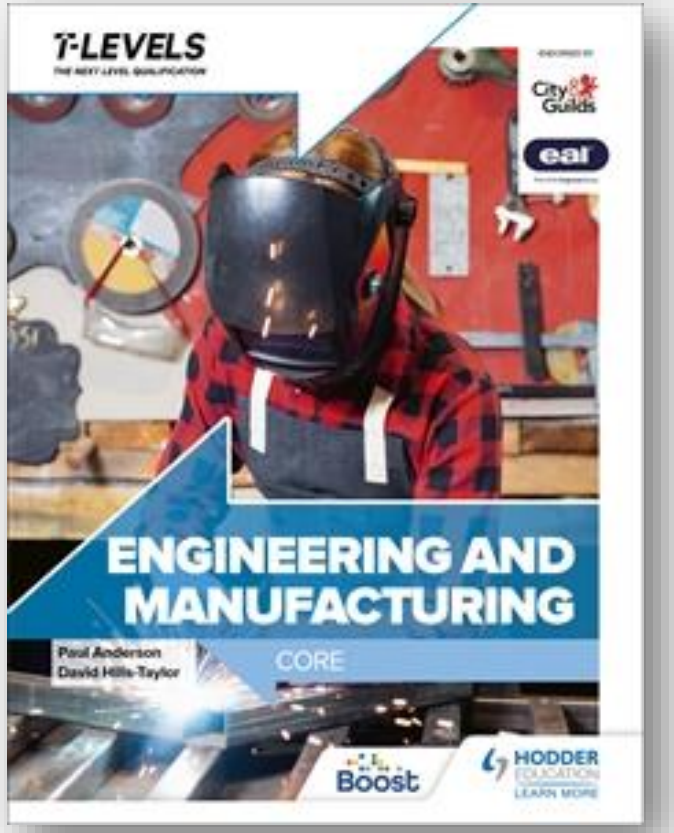

Contact Gemma Simpson to receive an advance sample chapter:
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T Level Associate Vacancies

Would you like to be involved with supporting the delivery of T-Levels?

- **Principal Moderators / Moderators**

Ensure a standardised and consistent approach to quality assurance, moderation, feedback and processes

- **Technical Qualification Associates (TQAs)**

Review Eligible Provider approval applications, including supplementary evidence and carry out approval and support activities.

- **Chief/Principal Examiners**

Produce and submit assessment materials and participate in all stages of the production process until sign off.

- **Marking Examiners**

Mark candidates' scripts/evidence in accordance with the agreed marking scheme/criteria within the agreed timescale

For further information, please contact Samantha.Ashman@cityandguilds.com or visit our website on the attached link: Associate Vacancies | City & Guilds Group Careers

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Questions?
Thank you for attending

November 2022

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