Engineering

Level 1 Principal Learning

Specification (7331)
Assessment 2009 onwards

This Principal Learning specification should be read in conjunction with:

- Specimen assessment materials and mark schemes for Principal Learning
- Teacher guidance materials for Principal Learning
- Examiners' Reports for Principal Learning
- Specifications for other components of Diplomas ie Functional Skills specifications, Project specifications and Additional and Specialist Learning specifications

This specification will be published annually on our website (**http://www.diplomainfo.org.uk**). We will notify centres in writing of any changes to this specification. We will also publish changes on our website. The version of the specification on our website will always be the most up-to-date version, although it may be different from printed versions.

You can get further copies of this specification from:

AQA Logistics Centre Unit 2, Wheel Forge Way, Ashburton Park, Trafford Park, Manchester M17 1EH
or you can download it from our website:
http://www.diplomainfo.org.uk

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Chris Jones Director General.

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1 Introduction

1.1 Why choose AQA-City & Guilds?

AQA is the UK's main provider of GCSEs and A levels. Over 3.5 million AQA examinations are taken every year and AQA is recognised by schools and colleges as the number one choice for customer service and high quality products.

City & Guilds is a household name for vocational qualifications. City & Guilds offers over 500 awards across a range of industries. With over 8500 centres in over 100 countries, City & Guilds is recognised by employers worldwide. It works closely with employers and industry bodies to ensure that its qualifications provide the benchmark standard for workplace skills and knowledge.

Diplomas are a blend of academic and vocational skills and that is why AQA-City & Guilds is the ideal choice for any school, college or consortium looking to offer them. The collaboration brings together the leading providers of qualifications in both fields to provide all the support you need to deliver them at one point of contact.

Why are AQA and City & Guilds so popular?

- **Specifications**
  These are designed to the highest standards, so that teachers, learners and learners' parents or guardians can be confident that an AQA-City & Guilds award provides an accurate measure of achievement. Assessment structures have been designed to achieve a balance between rigour, reliability and demands on learners and teachers.

- **Support**
  AQA-City & Guilds runs the most extensive programme of Diploma support meetings available in the UK; these are free of charge in the first years of a new specification and are offered at a very reasonable cost thereafter. These meetings explain the specification and suggest practical teaching strategies and approaches that really work. Further support is available from Diploma Advisors.

- **Service**
  AQA-City & Guilds Diplomas are administered from the AQA's offices in Manchester and Guildford. We are committed to providing an efficient and effective service and we are at the end of a phone when you need information, advice or guidance. We will try to resolve issues the first time you contact us and will work with you to find the solution.

- **Ethics**
  AQA and City & Guilds are registered charities. We have no shareholders to pay. We exist solely for the good of education. Any surplus income is ploughed back into educational research and our service to you, our customers. We don't profit from education, you do.

If you are an existing customer with either AQA or City & Guilds, we thank you for your support. If you are thinking of adopting AQA-City & Guilds for Diplomas, we look forward to welcoming you.

1.2 Why choose the Engineering Diploma?

The Engineering Diploma introduces learners to the world of engineering. It provides a gateway to the different sectors of engineering and the underlying systems and structures. Learners will acquire an understanding of the contribution engineering makes to modern life and of the career opportunities available.

The Diploma will enable learners to progress into further and higher education and future employment. Learners following an Engineering programme will also:

- develop Functional Skills in English, Mathematics and ICT
- produce a project which complements the Principal Learning and/or supports their progression
- have a particularly wide choice of Additional and Specialist Learning from which they can choose other qualifications which reflect their interests and abilities.

1.3 How do I start using this specification?

- Your school or college must pass through the Government Gateway process in order to receive approval to offer Diplomas in Engineering. Gateway 1 approved consortia start teaching Diplomas in 2008 and Gateway 2 is approving consortia to start teaching in 2009. More information is available on the DCSF website:
  (http://www.dfes.gov.uk)
- If you are a Gateway approved centre working as part of a consortium delivering Diplomas, you will also need to register your centre with us. (See Section 5.2.) This will enable AQA to ensure that you receive all the material you need to help you to deliver units and to enter your learners for examinations. This is particularly important where examination material is issued before the entry deadline. You can let us know by completing the appropriate registration forms. We will send copies to your exams officer and they are also available on the AQA website:
  (http://www.aqa.org.uk/admin/p_entries.html)
- Almost all examination centres in England and Wales are approved by either AQA or City & Guilds or both. A small minority are not. If your centre is new to both AQA and City & Guilds, please contact our centre approval section at:
  centreapproval@aqa.org.uk

1.4 How do I find out more?

Use Ask AQA – our online information service

Centres offering AQA-City & Guilds Diplomas will have 24-hour access to answers to the most commonly-asked questions at:
http://www.aqa.org.uk/rn/askaqa.php

If the answer to your question is not available you can submit a query for our team. Our target response time is two days.

Contact your Diploma Advisor

You may also contact the Diploma Advisor for your region. Please check current details on:
http://www.diplomainfo.org.uk

Diploma Advisors have particular expertise in:

- supporting centres and consortia on Gateway applications
- curriculum development and delivery including consortium operation
- assessment and quality assurance
- dealing with work experience.

Attend a Teacher Support meeting

Details of the full range of current Teacher Support meetings are also available on our website. There is a link to our fast and convenient online booking system for Teacher Support meetings at:
http://events.aqa.org.uk/ebooking/

If you need to contact the Teacher Support team you can call us on 01483 477860 or e-mail us at:
teachersupport@aqa.org.uk

Contact the Exams Office Support department

Our Exams Office Support department offers administrative support for the Diplomas. There is an office team to deal with your queries about:

- general administration
- general documents
- results documents
- timetable information
- publication orders.

You can contact us on 0870 410 1836 or e-mail: **eos@aqa.org.uk**

The department includes AQA's five Regional Officers who can provide up-to-date information, advice, support and guidance at a local level in your region. To contact the Regional Officer for your area, see:
http://www.aqa.org.uk/regional_officer.php

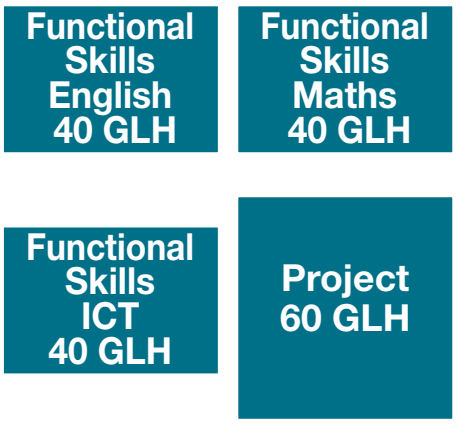
2 Specification at a glance

2.1 Foundation Diploma at a glance - 600 GLH (guided learning hours)

- comparable to 4 to 5 GCSEs
- 1 year FT study or 2 years PT with National Curriculum Programmes of Study
- all components are compulsory

1 Principal Learning Includes Personal, Learning and Thinking Skills (PLTS)

2 Generic Learning



3 Additional and Specialist Learning

4 Work Experience

2.2 Level 1 Engineering Principal Learning at a glance

- **all 7 units are compulsory**

Unit 1
30 GLH
Introducing the world of engineering
Externally assessed

Unit 2
60 GLH
Practical engineering and communication skills
Internally set and marked

Unit 3
30 GLH
Using Computer Aided Engineering
Internally set and marked

Unit 4
30 GLH
Routine maintenance operations
Internally set and marked

Unit 5
30 GLH
Introduction to engineering materials
Internally set and marked

Unit 6
30 GLH
Introduction to electronics
Internally set and marked

Unit 7
30 GLH
Engineering the future
Internally set and marked

3 Principal learning

3.1 Personal, Learning and Thinking Skills

The Framework of Personal, Learning and Thinking Skills 11-19 comprises six groups of skills that, together with the Functional Skills of English, mathematics and ICT, are essential to success in learning, life and work. For each group there is a focus statement that identifies the main PLTS in that group. This is followed by a set of outcome statements that are indicative of behaviours and personal qualities associated with each group of skills.

Each group of skills is distinctive and coherent. The groups are also inter-connected. Learners are likely to encounter skills from several groups in any one learning experience.

Listed below are the PLTS that are integrated within the assessment criteria in each unit. A copy of the PLTS framework should be given to each learner. Following these descriptors is a table showing the PLTS in the seven units of the Level 1 Engineering Diploma.

Independent enquirers
Focus: Young people process and evaluate information in their investigations, planning what to do and how to go about it. They take informed and well-reasoned decisions, recognising that others have different beliefs and attitudes.
Young people:
IE1 identify questions to answer and problems to resolve
IE2 plan and carry out research, appreciating the consequences of decisions
IE3 explore issues, events or problems from different perspectives
IE4 analyse and evaluate information, judging its relevance and value
IE5 consider the influence of circumstances, beliefs and feelings on decisions and events
IE6 support conclusions, using reasoned arguments and evidence

Creative thinkers
Focus: Young people think creatively by generating and exploring ideas, making original connections. They try different ways to tackle a problem, working with others to find imaginative solutions and outcomes that are of value.
Young people:
CT1 generate ideas and explore possibilities
CT2 ask questions to extend their thinking
CT3 connect own and others' ideas and experiences in inventive ways
CT4 question own and others' assumptions
CT5 try out alternatives or new solutions and follow ideas through
CT6 adapt ideas as circumstances change

Reflective learners

Focus:
Young people evaluate their strengths and limitations, setting themselves realistic goals with criteria for success. They monitor their own performance and progress, inviting feedback from others and making changes to further their learning.

Young people:
RL1 assess themselves and others, identifying opportunities and achievements
RL2 set goals with success criteria for their development and work
RL3 review progress, acting on the outcomes
RL4 invite feedback and deal positively with praise, setbacks and criticism
RL5 evaluate experiences and learning to inform future progress
RL6 communicate their learning in relevant ways for different audiences

Team workers

Focus:
Young people work confidently with others, adapting to different contexts and taking responsibility for their own part. They listen to and take account of different views. They form trusting relationships, resolving issues to reach agreed outcomes.

Young people:
TW1 co-operate with others to work towards common goals
TW2 reach agreements, managing discussions to achieve results
TW3 adapt behaviour to suit different roles and situations
TW4 show fairness and consideration to others
TW5 take responsibility, showing confidence in themselves and their contribution
TW6 provide constructive support and feedback to others

Self-managers

Focus:
Young people organise themselves, showing personal responsibility, initiative, creativity and enterprise with a commitment to learning and self-improvement. They actively embrace change, responding positively to new priorities, coping with challenges and looking for opportunities.

Young people:
SM1 seek out challenges or new responsibilities and show flexibility when priorities change
SM2 work towards goals, showing initiative, commitment and perseverance
SM3 organise time and resources, prioritising actions
SM4 anticipate, take and manage risks
SM5 deal with competing pressures, including personal and work-related demands
SM6 respond positively to change, seeking advice and support when needed

Effective participators

Focus:
Young people actively engage with issues that affect them and those around them. They play a full part in the life of their school, college, workplace or wider community by taking responsible action to bring improvements for others as well as themselves.

Young people:
EP1 discuss issues of concern, seeking resolution where needed
EP2 present a persuasive case for action
EP3 propose practical ways forward, breaking these down into manageable steps
EP4 identify improvements that would benefit others as well as themselves
EP5 try to influence others, negotiating and balancing diverse views to reach workable solutions
EP6 act as an advocate for views and beliefs that may differ from their own

This table shows the coverage of PLTS in the seven units of the Level 1 Engineering Diploma.

Level 1 Engineering Diploma

PLTS	IE	CT	RL	TW	SM	EP
Unit 1	*	*		*		
Unit 2			*		*	
Unit 3	*				*	
Unit 4	*		*		*	*
Unit 5	*				*	*
Unit 6	*		*		*	
Unit 7	*	*	*	*		*

3.2 Functional Skills signposting

The units may use and/or contribute towards the underpinning skills and knowledge of the Functional Skills in the following areas, depending on the precise nature of the work done in the Diploma.

The Diploma	Functional Skills		
Unit	**English**	**Mathematics**	**Information and Communication Technology**
Unit 1 Introducing the world of engineering	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1		• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1
Unit 2 Practical engineering and communication skills	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1	• Representing situations using Mathematics Level 1 • Analysing and processing using Mathematics Level 1 • Interpreting and presenting results Level 1	• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1
Unit 3 Using Computer Aided Engineering	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1	• Representing situations using Mathematics Level 1 • Analysing and processing using Mathematics Level 1 • Interpreting and presenting results Level 1	• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1
Unit 4 Routine maintenance operations	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1	• Representing situations using Mathematics Level 1 • Analysing and processing using Mathematics Level 1 • Interpreting and presenting results Level 1	• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1

Unit	English	Mathematics	ICT
Unit 5 Introduction to engineering materials	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1	• Representing situations using mathematics Level 1 • Analysing and processing using mathematics Level 1 • Interpreting and presenting results Level 1	• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1
Unit 6 Introduction to electronics	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1	• Representing situations using Mathematics Level 1 • Analysing and processing using Mathematics Level 1 • Interpreting and presenting results Level 1	• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1
Unit 7 Engineering the future	• Speaking and listening Level 1 • Reading Level 1 • Writing Level 1		• Use ICT systems Level 1 • Find and select information Level 1 • Develop, present and communicate information Level 1

3.3 The three themes of the Level 1 Engineering Diploma

The principal learning of the Level 1 Engineering Diploma is centred around three themes:

Theme A: The engineered world encourages learners to pursue a career in engineering by challenging misconceptions and demonstrating that engineering is a worthwhile and exciting career choice. It gives learners an understanding of the 'made world' and of the impact that technology and manufacturing have on peoples' everyday lives.

Theme B: Discovering engineering technology encourages learners to discover fundamental engineering principles by investigating manufacturing and maintenance techniques, understanding engineering communication and using Computer Aided Engineering.

Theme C: Engineering the future introduces learners to new engineering technologies and prospects for the future.

3.4 Level 1 Units

Level 1 Unit 1: Introducing the world of engineering (ENG1U1)

What is this unit about?

The purpose of this unit is for learners to understand why engineering is important to the social and economic development of our world. Learners will be introduced to the benefits produced by technological advancement. This unit also includes the concepts of sustainability and accountability, and the requirement for the Engineering industry to operate in a way which ensures that there is minimal impact on the environment.

Learners will develop research and investigative skills when exploring the contribution of engineering, as well as looking at the impact of sustainability, green issues and legislation on the way in which the Engineering industry operates. Since team working is regarded as being of vital importance in engineering, as it is in most other industrial sectors, learners will work in teams and develop presentation and communication skills.

Learners must both review their own work and get feedback from others. They should use the review and feedback to improve their work. As this is Unit 1 and intended to introduce learners to the wider aspect of engineering and career opportunities, it should be used as a starting place for experiential learning.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 know about the different sectors within the Engineering industry, and the types of jobs available in the industry

2 understand the contribution of engineering to the social and economic development of our world

3 understand how environmental and sustainability issues, and legislation, affect the operation of the Engineering industry.

Assessment criteria

1 Sectors and types of jobs within the Engineering industry

The learner can:

a identify the sectors that make up the Engineering industry, such as:

- i oil, gas and chemical manufacture
- ii energy generation and distribution
- iii nuclear technologies
- iv waste management and water
- v transport infrastructure and vehicle systems
- vi built environment engineering
- vii engineering manufacture and maintenance
- viii automotive trades

b identify and describe the types of jobs available within the Engineering industry:

- i apprenticeships
- ii operatives
- iii technicians
- iv research and development
- v drawing office.

2 The contribution of engineering to the industrial world

The learner can:

a investigate the contribution engineering makes to the social and economic development of the world we live in, such as (IE2, 5) (CT2):

- i electrification and the National Grid
- ii vehicle design, technology and safety
- iii water treatment, distribution and waste management
- iv electronics
- v agricultural mechanisation
- vi household appliances and refrigeration
- vii chemical engineering
- viii space technologies

b work as a member of a team when carrying out research on the contribution engineering makes to social and economic development:

- i allocating roles (TW3)
- ii working towards common goals (TW1)
- iii providing support and feedback to others (TW6).

3 Sustainability, green issues and legislation

The learner can:

a identify sustainability and green issues which affect the way that the Engineering industry operates, with reference to:

- i sources of energy
- ii uses of energy
- iii long-term problems of supplying enough energy, such as global warming

b describe the benefits of being environmentally friendly

c describe the impact of legislation on the way that the Engineering industry operates with reference to:

- i environmental legislation
- ii Health and Safety legislation.

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through an external examination set and marked by AQA-City & Guilds.

The external assessment is a compulsory component of the qualification and is designed to test learners' ability to relate their learning to varying contexts, and to demonstrate the level of understanding they have reached about various aspects of the world of engineering.

Examinations will be available twice a year and the dates will be published at the start of each academic year. The examination will take place under controlled examination conditions.

The examination will consist of two parts.

Part A

This will cover Assessment criteria topic 2 and will be based on pre-release material. At a specified date prior to the examination, learners will be given pre-release case study material on one significant engineering contribution (see examples given under Assessment criterion 2a). In preparation for the examination, learners will need to investigate this engineering contribution and how it has contributed to social and economic development. They should investigate how the engineering contribution impacts upon industry, homes and people's lives.

The investigations will be carried out in teams and the findings shared and communicated to the group as a whole. Engaging in this activity will enable learners to participate effectively and develop skills in research and investigation. In communicating their findings, the learner will cover a wide range of Personal, Learning and Thinking Skills. **Learners will need to participate in group work in order to be fully prepared for the examination. The teamwork element of the task will be covered by the examination.**

Learners will only be allowed to take the pre-release case study material into the examination with them and will answer short, structured questions on the engineering contribution.

Part B

This will cover Assessment criteria topics 1 and 3 and will consist of short answer questions.

This will enable learners to demonstrate their knowledge and understanding of the Engineering sectors, jobs available, sustainability, green issues, and legislation.

Examination specification

Duration: 90 minutes

Assessment type: Short answer questions

Number of marks: 48 marks

Assessment criteria topic	Subtopic	No of marks	Total mark	%
Part A				
2 The contribution of engineering to the industrial world	How the engineering contribution impacts upon: • industry • home • people's lives	8	16	33
	Team working	8		
Part B				
1 Sectors and job roles within the Engineering industry	Sectors	6	20	42
	Types of jobs	6		
	Typical activities of people employed in the Engineering industry	8		
3 Sustainability, green issues and legislation	Sources of energy	2	12	25
	Uses of energy	2		
	Problems in energy use	2		
	Benefits of being environmentally friendly	4		
	Legislation	2		
	Total	48	48	100

Guidance for delivery

This unit will provide learners with knowledge of the sectors that make up the Engineering industry, including: manufacturing; energy generation and distribution; nuclear technologies; waste management and water resources; transport infrastructure and vehicle systems (including automotive, aerospace, railway and marine); built environment engineering (including building services engineering, civil engineering and structural engineering) and maintenance.

Learners will also widen their understanding of the types of jobs which are available within the Engineering industry.

It would be very beneficial to invite guest speakers from local engineering businesses to the centre. The speakers would be able to share their first-hand experience of job roles within various Engineering sectors.

Learners will investigate the ways in which engineering has impacted on the social and economic development of the world and on their everyday lives. This investigation could focus on one of the following:

- the development of electrification and the National Grid
- vehicle design and technology
- water treatment, distribution and waste management
- the development of electronics eg household appliances and refrigeration
- agricultural mechanisation
- chemical engineering
- aerospace technologies.

As detailed in the Assessment section of this unit, the specific context for this work will be provided through pre-release material made available to centres at a specified date, prior to the examination. Learners will work together in small teams to explore various aspects of the task.

Learners will also explore sustainability issues which are relevant to the Engineering industry. This should focus on the sources, such fossil fuels, renewable energy and nuclear energy, and uses of energy, including transportation, industrial processes, heating and cooling, and electrical equipment. The benefits of being environmentally friendly and the long-term problems of the supply and use of energy, such as global warming and sustainable energy networks, should also be covered.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- Energy Saving Trust www.energysavingtrust.org.uk
- WorkSMART www.worksmart.org.uk
- Young Engineers www.youngeng.org
- NetRegs www.netregs.gov.uk
- Earth Trends www.earthtrends.wri.org
- Carbon Trust www.carbontrust.co.uk

Opportunities for applied learning

Opportunities for applied learning will largely be through project work and investigation of particular topics.

Structured and appropriate visits to sites, such as industrial plants, recycling centres, power stations, science parks and industrial sites could be used to increase the learner's awareness of the topics covered by the unit. It would also be useful for learners to visit local engineering businesses which could provide insight into Engineering industries and their contribution to local social and economic development.

Learners could demonstrate effective participation and teamwork when visiting sites or projects and investigating engineering sectors and their contribution to our everyday lives.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- planning and carrying out research on sectors of Engineering
- researching the impact of engineering on their everyday lives
- analysing and evaluating the information obtained as a part of the research process
- judging the relevance and value of the information obtained

Creative thinkers

- generating ideas on the best way to present information
- asking questions on topics being studied

Reflective learners

- inviting feedback and reviewing progress on their research

Team workers

- providing constructive support and feedback to others

Self-managers

- working towards goals and organising time and resources to meet these goals

Effective participators

- trying to influence others when discussing the impact of issues such as global warming.

Level 1 Unit 2: Practical engineering and communication skills (ENG1U2)

What is this unit about?

The purpose of this unit is to introduce learners to the work of the Engineering sector, in which the application of basic manufacturing and assembly techniques is fundamental to the wider aspects of engineering manufacture and maintenance.

This unit will provide learners with the opportunity to develop Health and Safety awareness and will emphasise the importance of using safe working practices. As part of their wider experience of elementary engineering processes and techniques, learners will develop basic skills to enable them to safely carry out simple cutting, forming and joining operations. This knowledge and experience of cutting, forming and joining engineering materials to produce products will help learners to understand the importance of basic practical skills and how they impact on their everyday lives.

This is a practically focused unit where learners will work with common materials and relevant tools and equipment to gain an understanding of how they can be used to make engineered products. They will learn how to produce and use drawings and sketches, and begin to understand the importance of these as a vital means of communicating information.

Learners must both review their own work and get feedback from others. They should use the review and the feedback to improve their work.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 be able to produce and interpret simple engineering drawings and sketches

2 be able to select and use tools and equipment to measure and mark out, and perform cutting, forming and joining processes

3 know how to apply Health and Safety standards when organising a safe working area for practical engineering activities.

Assessment criteria

1 Produce and interpret drawings

The learner can:

a communicate technical information by reading and interpreting basic engineering drawings which conform to sector standards, sketches and written instructions (RL6):
   i schematic
   ii orthographic
   iii procedure sheets
   iv charts and manufacturers' publications
   v electronic data

b produce simple drawings and diagrams to communicate technical information (RL6).

2 Plan safe manufacturing and assembly activities and use tools, equipment, materials and components

The learner can:

a prepare and follow basic work plans (SM3)

b measure and mark out metallic and non-metallic materials to produce engineered products

c select and use hand tools and basic workshop processes safely for:
   i cutting (including small powered tools)
   ii drilling
   iii forming
   iv joining

d check the functionality and quality of a manufactured product against the specification (RL3)

e assemble and disassemble finished products to check against the specification.

3 Apply Health and Safety standards

The learner can:

a consider the importance of Health and Safety requirements when working in an engineering environment by following:
   i Health and Safety at Work guidelines
   ii Control of Substances Hazardous to Health (COSHH) guidelines
   iii the correct procedure when preparing for an engineering activity
   iv safe working procedures in the workshop
   v written safety instructions and displayed notices

b apply the appropriate Health and Safety requirements for workshop activities (SM4):
   i identifying and eliminating hazards
   ii checking all safety equipment
   iii sourcing and confirming suitability of personal protective equipment (PPE)
   iv confirming process operating safety measures.

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 60 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

The learner will complete an assignment which will enable them to complete this practical unit and to meet the evidence requirements in their local context.

A common industrial process is the manufacture of single or small quantities of parts for specific purposes, such as repair or development. In this assignment, learners will produce the drawing(s) of such a part and plan its manufacture. They will then make the component and report on any changes or testing which are required.

The assignment will take approximately 15 of the 60 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification, and evidence should be kept for moderation purposes. If it is not practical to keep the product or assembly, a photographic record should be kept, along with a signed statement verifying that it is the learner's own work.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a work plan identifying manufacturing processes, equipment, materials and components, and appropriate Health and Safety standards to be applied, based on the provided product specification and drawings

2 a basic engineering drawing or sketch

3 a product or assembly that meets the requirements

4 a record of testing carried out and modifications made.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the Assessment criteria topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Using the provided product (component) specification and drawings, produce a work plan which identifies manufacturing processes, equipment materials and components.
- Produce a drawing which meets sector standards from the provided sketch.
- On the sheet provided, record any joint discussion or data evaluation that occurred when using drawings or provided data. Any additional drawings or sketches should also be recorded.
- Produce a list of the appropriate PPE required and any specific safety procedures that should be followed.
- Produce an engineered product or assembly and explain:
  - how closely it matches the specification
  - any procedures followed or problems encountered in ensuring the required standard was achieved.
- Record any testing carried out and explain why the method used was appropriate.
- Record any modifications made during production to ensure the quality of the finished product or assembly met the specification.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 Produce and interpret drawings	25%	12
2 Plan safe manufacturing and assembly activities and use tools, equipment, materials and components	62.5%	30
3 Apply Health and Safety standards	12.5%	6
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptors in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 Produce and interpret drawings	0 – 4 marks Attempted an interpretation of basic drawings and data. Produced a simple drawing which contains faults or mistakes.	5 – 8 marks Interpreted drawings and data correctly. Produced a drawing which was generally accurate and generally complied with sector standards.	9 – 12 marks Interpreted drawings and data accurately and appropriately. Produced an accurate and detailed drawing which complied with sector standards.
2 Plan safe manufacturing and assembly activities and use tools, equipment, materials and components	0 – 10 marks Produced a basic work plan for making an engineered product from given data; made some reference to tools, equipment, materials and processes. Worked within wide tolerances using a reduced range of materials to produce a basic product or assembly. Selected and used a limited range of tools and processes. Needed more than one attempt to produce the item to the required standard and some minor tasks were incomplete.	11 – 20 marks Produced a clear, basic work plan for making an engineered product; identified the range of tools, equipment, materials and processes required for the activity. Used a range of materials and assemblies to produce an adequate product or assembly which met basic quality standard requirements. Selected and used a range of tools and processes including cutting, drilling and forming. Worked so that the task is completed close to schedule.	21 – 30 marks Produced a comprehensive and well-structured work plan for making an engineered product based on informed decisions reached after analysing information; selected an appropriate range of tools, equipment, materials and processes required for the activity. Used a wide range of materials and components to produce a component or assembly with some precision which met quality standard requirements. Selected and used a range of tools and processes including cutting, drilling and forming to a good standard. Worked so that the task is completed systematically and as scheduled.

Assessment grid (continued)

Assessment criteria topic	Band 1	Band 2	Band 3
	Attempted to carry out simple quality checks.	Used measurement equipment adequately to check that quality standards requirements have been met; recorded any modifications or alterations.	Used tools, equipment and measuring devices correctly to ensure specification requirements were fully met; recorded in detail the task and test results; adequately justified any modifications or alterations required and suggested possible improvements or alternative processes.
3 Apply Health and Safety standards	0 to 2 marks Understood the need for Health and Safety procedures. Normally used PPE.	3 to 4 marks Complied with Health and Safety procedures. Used appropriate PPE.	5 to 6 marks Complied with and shown an active awareness of Health and Safety procedures. Selected and used appropriate PPE.

3

Guidance for delivery

Learners should be allowed ample opportunity to become familiar with essential Health and Safety requirements in a workshop situation by considering the implications of the relevant legislation regarding Health and Safety at Work guidelines and COSHH.

Learners should understand that in order to make products of an acceptable quality, the materials, components, tools and equipment must be prepared properly and checked before starting any manufacturing activities. Before starting work, learners will need to carry out the following procedures:

- eliminate potential hazards
- locate fire exits and extinguishers
- source tools and confirm fitness for purpose
- source equipment and confirm fitness for purpose (check all guards and safety devices)
- source and confirm suitability of required PPE
- apply Health and Safety procedures in the workshop
- locate emergency stops
- read signs and charts
- ensure correct behaviour.

Emphasis on the importance of careful preparation will also underpin the relationship with safe, efficient and effective production techniques.

Learners will produce, read and interpret written instructions, basic engineering drawings and sketches used for measuring and marking material accurately. They should learn how to plan the sequence of operations that contribute to a manufacturing activity.

Production practices will vary according to the chosen product(s). However, learners should explore the use of a wide range of workshop tools and equipment on both metallic and non-metallic materials. Their work should also embrace mechanical and electrical/electronic activities. Ideally these activities would include the use of:

- cutting by hand and powered tools:
  - sawing
  - filing
  - chiselling
  - machining
- fixed and portable drilling
- forming:
  - bending
  - folding
  - rolling
  - grooving
  - moulding
  - casting
- joining:
  - screws
  - nuts and bolts
  - rivets
  - adhesives
  - soldering.

Manufacturing can be carried out either individually or as part of group work, but a thorough evaluation and discussion of all aspects of the planning, measuring, marking out and component production is an essential part of the assessment. Learners should apply appropriate checks for accuracy and suitability of the manufactured product(s) and be able to make a distinction between forms of assembling and dismantling to understand the relationship between assembled components. Learners should be familiar with using:

- fastening devices
- gaskets and seals
- locking devices
- permanent and non-permanent joints
- the correct sequence (apply the general rules for assembly and dismantling)
- match-marking of component parts
- procedure sheets, manuals or equivalent.

Learners should be encouraged when checking products against the specification/drawing or worksheet to handle finished and fragile items/components carefully and safely.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- workshop or laboratory facilities
- simple hand tools, drilling machines, vices, spanners, hammers, chisels, files
- simple bending/folding machinery, guillotines, bench drill, rolls
- a range of joining equipment and tools
- datasheets or information contained in catalogues, manufacturers' publications, manuals and handbooks.

Opportunities for applied learning

Although this unit, which is delivered and assessed through practical work, will involve a significant amount of workshop activity, learners will also benefit from visits to companies involved in the manufacture of small components or assemblies, as this will give an insight into how commercial products are manufactured from drawings and specifications. Visits will also allow learners to understand how information and data are used at all stages of manufacture, from raw material through component production to assembly and inspection/quality control.

Learners must be made aware of the need for common standards to be applied within a sector. When producing or interpreting drawings, they need to become familiar with basic conventions, projections and dimensioning systems.

Learners will also get an insight into the range of Health and Safety considerations that companies are required to give to the working environment in order to ensure the safety of their workforce. Larger companies that manufacture using more than one engineering process will also be able to provide evidence of work scheduling and planning, which will help learners in planning their own activities.

Learners should be given the opportunity to use a range of different measuring and marking out techniques on different materials, and to select the most appropriate workshop processes to cut, form and join/assemble an engineered product.

In creating their own work plan, learners will gain skills in reading and interpreting drawings and data, identifying and solving production problems, and giving consideration to the basic requirements of control to ensure the finished product is fit for purpose.

What activities might be involved in this unit?

- Working safely in an engineering environment using a range of tools and equipment.
- Using drawings, sketches and data in the process of making a product.
- Assembling and disassembling engineered products.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- deciding which engineering processes, materials and components are required
- using the correct tools and equipment safely and effectively

Creative thinkers

- thinking creatively about work plans or procedure sheets to organise an efficient sequence of operations

Reflective learners

- inviting advice or feedback to improve the effectiveness or efficiency of an engineering operation

Team workers

- working with others in a safe workshop environment and providing support as necessary

Self-managers

- organising time and resources to complete an engineering activity within the allocated time
- checking the functionality and quality of a manufactured product against the specification

Effective participators

- proposing practical ways of problem solving and breaking problems down into manageable steps.

Level 1 Unit 3: Using Computer Aided Engineering (ENG1U3)

What is this unit about?

The purpose of this unit is to provide the learner with the opportunity to investigate the use of computer software packages and systems in the design and manufacture of engineering components. It is a practical unit in which the learner will design and manufacture a simple component that is machined in two dimensions.

Computer Aided Engineering is an important aspect of modern engineering practice, and learners need to be made aware that increasing use is made of computer based technologies when designing, manufacturing or controlling processes.

This unit serves as an introduction to Computer Aided Engineering and is divided into two sections: Computer Aided Design (CAD), and using computer numerical controlled (CNC) machines. In the CAD section, learners will produce orthographic drawings which conform to standards and can be used as a basis for subsequent manufacture. When producing simple two dimensional components using computer controlled methods, learners will discover how to set and operate the equipment.

This unit will provide sufficient knowledge and experience to enable learners to progress further in this aspect of engineering manufacturing.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 understand how Computer Aided Engineering integrates the design and manufacture of products

2 be able to use a Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) system.

Assessment criteria

1 Understand Computer Aided Engineering

The learner can:

a describe how computer software packages are used to design products (IE4)

b describe how computer software packages are used to control the operation of machine tools

c describe how the design and manufacture of products can be integrated under the banner of Computer Aided Engineering

d explain the importance of Computer Aided Engineering as a manufacturing technique.

2 Use Computer Aided Engineering Systems: CAD-CAM

The learner can:

a use a CAD system to produce engineering component drawings which contain mechanical engineering conventions, including dimensioning and standard components (SM3)

b use a CAD system to produce circuit diagrams containing electrical, electronic circuit symbols

c produce drawings using CAD software for orthographic projection and isometric views of components and assemblies

d use a CAM software package to convert an engineering drawing of a component into a program that can be used to operate a machine tool by:

i producing a 2D CAD drawing

ii using software which converts 2D CAD files into machine instructions (SM2)

e use a CAM system to produce a simple component.

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

Increasingly, engineering manufacturers are moving to using CAD-CAM systems of production, as this provides increased efficiency and flexibility. In this assignment, learners could be performing the role of an engineer who needs to produce a component by this method.

The learner will complete an assignment which requires them to produce a simple component using CAD-CAM. The component will need to be sufficiently complex to challenge the learner and justify the use of the technology.

The assignment will take approximately 10 of the 30 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification, and evidence should be kept for moderation purposes. If it is not practical to keep the component, a photographic record should be kept, along with a signed statement verifying that it is the learner's own work.

The learners will need to be provided with a sketch of a component.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a brief summary of Computer Aided Engineering processes in industry and reasons for their use.

2 2D CAD drawing(s) (mechanical drawings and electrical/electronic diagrams)

3 a file which contains the data required for manufacture

4 a CAM produced outcome or simple component.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the assessment topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

3

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Write a brief explanation of the use of Computer Aided Engineering in industry, including design and production. Photographs and diagrams may be included.
- Using the provided sketch diagram of a circuit, produce an electrical or electronic circuit diagram using a CAD system.
- Using the provided sketch of a component and a recording form, produce a complete 2D CAD drawing showing all the essential information for making the component, including important dimensions where necessary.
- Produce a file which can be transferred to a CNC machine for controlling machine operations.
- Set the machine up.
- Machine the component.
- Check the component against the drawing and explain how accurately it has been produced compared with the CAD drawing.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 Understand Computer Aided Engineering	25%	12
2 Use Computer Aided Engineering Systems: CAD-CAM	75%	36
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptions in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 Understand Computer Aided Engineering	0 – 4 marks Briefly explained the importance of Computer Aided Engineering. Described a basic CAD and CAM operation.	5 – 8 marks Explained in general terms how computer aided systems operate and the importance of Computer Aided Engineering. Described CAD and CAM operations in simple terms.	9 – 12 marks Explained in detail how using CAD-CAM relates to industrial practices, and the importance of Computer Aided Engineering in industry. Described CAD and CAM operations in detail.
2 Use Computer Aided Engineering Systems: CAD-CAM	0 – 12 marks Produced drawings of limited accuracy, using a restricted range of techniques. Attempted to transfer data between a CAD and CAM system. Worked within tolerances using a reduced range of materials. Used a CAM system to produce an outcome which meets a minimum of specification requirements. Needed more than one attempt to produce work to a basic standard.	13 – 24 marks Produced adequate drawings, using a range of techniques. Transferred data between a CAD and CAM system. Worked accurately using a restricted range of materials. Used a CAM system to produce an outcome which meets parts of the specification. Completed work and met standard requirements.	25 – 36 marks Produced accurate component or assembly drawings, using a wide range of techniques. Successfully transferred data between a CAD and CAM system. Worked precisely with a full range of materials. Used a CAM system to produce an outcome which meets the specification. Completed work to schedule and with an accuracy which meets quality standard requirements.

Guidance for delivery

In common with other units at this level, the most appropriate method of learning will involve active participation in a range of activities using drawing software and machining parts. Learners may have experienced using these technologies during KS3 Design and Technology lessons, but will need to assimilate the requirements of an engineering environment.

It is important to provide opportunities in other units for this work to be developed further, such as in Level 1 Unit 2: Practical engineering and communication skills, where there are opportunities for using the content of this unit.

Learners will need to work with more than one technology when using CAD systems. They must be able to produce circuit diagrams using libraries of electrical or electronic circuit symbols. The learner should also use two different two axes machining methods, eg turning and milling or laser cutting.

All learners will need to be aware of the conventions for diameters, centrelines, sections, dimensioning and fastenings.

Learners should be able to manipulate drawings using the following features of the software:

- grids
- layers
- view
- zoom
- scale.

Learners should be able to use the following editing techniques:

- copy
- move
- rotate
- erase
- trim
- chamfer and fillet
- change colour, line thickness, line type, etc.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- suitable software packages, eg Corel draw, Techsoft 2D, Autosketch, PRO-Desktop, Solid Works Multisim, PCB Wizard
- computer controlled tools such as laser cutters, milling machine/router or centre lathe.

Opportunities for applied learning

Work carried out in this unit will find application across a range of Engineering sectors. Learners will experience these technologies being used on work experience and industrial visits, in addition to using them first-hand in their school, college or training centre.

The context of this unit will encourage learners to more fully understand the application of mathematics to engineering processes, such as the numerical control of machines and designing.

Since part of the unit requirement is to produce drawings using standard component symbols (eg electrical/electronic circuit symbols), learners will need to become familiar with these devices and to understand their use in engineering systems.

What activities might be involved in this unit?

- Using CAD to produce a drawing of a component.
- Producing the component using CAM, by converting a CAD drawing into a program which can operate and set a machine tool, including setting the machine.

Suggested prior learning

Learners should be familiar with the operation of personal computer systems and have used some CAD-CAM in KS3 Design and Technology.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- planning and carrying out research, appreciating the consequences of decisions when converting a drawing for manufacturing

Creative thinkers

- producing drawings or programs
- trying out alternatives or new solutions and following ideas through

Reflective learners

- assessing themselves and others when completing work, such as producing drawings or machining components

Team workers

- co-operating with others when producing components to pre-set timescales

Self-managers

- working towards goals, showing initiative and perseverance when completing work

Effective participators

- breaking the process of planning for manufacturing into manageable steps
- negotiating with others to gain access to machines with limited availability.

Level 1 Unit 4: Routine maintenance operations (ENG1U4)

What is this unit about?

The purpose of this unit is to introduce learners to routine maintenance operations. Learners will understand the importance of ensuring that equipment and systems operate correctly to specification. The unit has a practical focus and learners will perform basic maintenance routines and fault-finding tasks which require the use of simple hand tools, measuring equipment, product information and reporting documentation.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 be able to interpret and use technical terms, measurements and data relating to routine engineering maintenance procedures

2 understand the hazards and risks associated with maintenance, and be able to work responsibly and report Health and Safety issues

3 be able to select and use appropriate engineering tools, equipment and materials used to carry out routine maintenance procedures

4 know how to complete documents and records for procedure undertaken.

Assessment criteria

1 Routine engineering maintenance procedures and accessing data

The learner can:

a describe and carry out the various examination procedures:

- i aural
- ii visual
- iii functional

b use technical terms, data and measurements relating to engineering maintenance

c describe how to find, interpret and use sources of technical information

d use technical information, including drawings and manuals, to support all maintenance activities (IE4).

2 Hazards and risks associated with maintenance activities

The learner can:

a describe legal duties and their responsibility for Health and Safety

b report Health and Safety matters promptly and to the relevant person, including (SM4):

i identifying any hazards that may exist in a workplace

ii describing safe working practices, realising the need for safe personal conduct

c demonstrate the skill to work safely, including the use of personal protective equipment (PPE) (SM3, 4).

3 Carrying out maintenance operations

The learner can:

a select and use correct tools, equipment and materials safely and correctly when carrying out engineering maintenance operations such as measurement, inspection, adjustment, assembly and disassembly (SM3)

b investigate causes of failure (IE4) (RL5).

4 Documenting maintenance procedures

The learner can:

a explain the importance of documenting maintenance operations (EP2)

b plan and record maintenance procedures.

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

Maintenance operations are completed on a routine basis in all aspects of the Engineering industry and the assignment should ideally be applied to work-related practice.

A combination of practical activities and recording should be undertaken. The learner should perform a routine maintenance task and carry out a simple fault-finding task to locate a cause of failure, or a component which is at risk of failure, perhaps through wear, mechanical damage or leakage. Reference material should be used to ensure compliance with manufacturers' or others' procedures. Operations should be recorded using normal record sheets supported by photographic evidence and a brief summary of the methods used.

The learner will complete an assignment, which will take approximately 7 of the 30 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification. This will involve direct supervision of the learner whilst completing all parts of the assignment, and evidence should be kept for moderation purposes. Where the learner works away from the centre, eg in a commercial repair facility, the centre must ensure that any evidence submitted for assignment is the learner's unaided work. This should be supported by a witness statement.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a record of the examination procedures, inspection and planning

2 references to any drawings, diagrams or manufacturers' data or instructional material used

3 a description and photographic record of the operations carried out, tools, equipment and materials used, and Health and Safety issues

4 a documented record of the completed maintenance task and fault-finding task, which investigates a cause of failure.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the Assessment criteria topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

3

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Inspect and describe the maintenance task to be completed, recording examination procedures, findings and work to be carried out.
- Find, interpret and use sources of technical information, and keep a list of all sources used.
- Record any Health and Safety issues which need to be taken into account and demonstrate an understanding of Health and Safety and required working practices.
- Select tools, equipment and materials needed to complete the maintenance task.
- Show an ability to follow instructions and complete the maintenance task to schedule.
- Carry out a simple fault-finding task to investigate causes of failure and report the findings.
- Record all procedures followed, including photographs.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 Routine engineering maintenance procedures and accessing data	25%	12
2 Hazards and risks associated with maintenance activities	12.5%	6
3 Carrying out maintenance procedures	50%	24
4 Documenting maintenance procedures	12.5%	6
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptions in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 Routine engineering maintenance procedures and accessing data	0 – 4 marks Briefly described and carried out simple examination procedures for routine inspection. Used simple drawings, diagrams and manuals, and limited technical terms.	5 – 8 marks Described and carried out simple examination procedures for routine inspection. Used a range of drawings, diagrams and manuals, and limited technical terms.	9 – 12 marks Described in detail and comprehensively carried out examination procedures for routine inspection. Used and interpreted a range of drawings, diagrams and manuals to obtain the correct technical information; used technical terms correctly.
2 Hazards and risks associated with maintenance activities	0 – 2 marks Shown a limited understanding of Health and Safety issues, PPE and their responsibilities in the workplace. Worked safely and identified simple hazards.	3 – 4 marks Shown a good understanding of Health and Safety issues, the use of PPE and their responsibilities in the workplace. Worked safely and identified hazards and appropriate action to be taken.	5 – 6 marks Shown a clear and detailed understanding of their duties and responsibilities in the workplace, including the use and provision of PPE and Health and Safety issues. Worked safely all, or most of the time; identified hazards and reported problems or unexpected events to the responsible person.

Assessment grid (continued)

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
3 Carrying out maintenance procedures	0 – 8 marks Followed mainly verbal instructions and completed a maintenance task which was predominantly related to the limited repair or maintenance of a single item; partially identified a fault which is a cause of failure. Worked safely with a limited range of tools, equipment and materials. Normally worked in a responsible manner.	9 – 16 marks Followed simple step-by-step instructions to enable them to complete a maintenance task which was predominantly related to the limited repair or maintenance of a single item; identified a fault which is a cause of failure. Worked safely with a range of tools, equipment and materials. Worked in a sensible and responsible manner.	17 – 24 marks Followed instructions provided by manufacturers or others and successfully completed a maintenance task; investigated and identified a fault which is a cause of failure and suggested possible rectification procedures. Selected tools, equipment and materials; used tools, equipment and materials safely and accurately. Worked reliably and independently on tasks but co-operated well with others.
4 Documenting maintenance procedures	0 – 2 marks Completed simple records of the procedures.	3 – 4 marks Documented all procedures completed.	5 – 6 marks Documented, accurately and in detail, all procedures carried out.

Guidance for delivery

This unit is aimed at learners not only understanding the importance of engineering maintenance, but also developing the practical ability to carry out basic maintenance routines to schedule.

Opportunities should be devised which produce an exciting, stimulating and challenging programme, within the selected area, using a range of tools and equipment, in line with current industrial practices.

At Level 1, the learner will be concerned with routine maintenance operations and carrying out basic fault-finding to investigate causes of failure. A simple fault-finding task could be to locate a component which is at risk of failure, perhaps through wear, corrosion, mechanical damage or leakage.

Suggested tasks

For mechanical engineering and production maintenance, these tasks could include checking and making adjustments to drive systems, gears, bearings, levels, rollers.

For engineering systems (engines/plant) these could include work involving clearances, gaps, levels, belts, pulleys, chains and the replacement of components such as bearings.

For motorcycle and bicycle maintenance, these could include work involving clearances, gaps, levels, chains, bearings and the replacement of components, for example brakes.

For electrical and electronic engineering maintenance, these could include work involving industrial or residential installation components, computer hardware and software, and radio and television components.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- CD interactive material, eg CDX, Digital Press
- How stuff works:
  www.howstuffworks.com

Opportunities for applied learning

There is ample opportunity within the maintenance areas of various Engineering sectors for learners to gain experience of maintenance activities. Maintenance can be carried out alongside production or in a dedicated environment such as automotive servicing, electronic repair or computer repair.

Additionally, learners may work on group projects which require setting and adjusting operations to be carried out, such as a go-kart challenge, robotic competitions or mileage marathons.

In these and many other situations, they will be able to apply the knowledge and understanding of the content of this unit to workplace situations.

What activities might be involved in this unit?

- Using PPE correctly.
- Identifying risks and maintaining Health and Safety when working.
- Planning maintenance work to schedule.
- Carrying out maintenance activities.
- Investigating causes of failure.
- Reporting on maintenance activities carried out.

Suggested prior learning

Learners will have used tools and equipment at Key Stage 3 in Design and Technology lessons, but will need to be inducted into industrial working methods.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- independently deciding which areas of the machines and equipment need to be maintained
- planning and organising relevant maintenance procedures
- exploring ways of maintaining machines and equipment

Creative thinkers

- trying out cost-effective, efficient and eco-friendly methods of maintenance
- thinking creatively about methods for producing maintenance records

Reflective learners

- evaluating their maintenance procedures for reliability and efficiency

Team workers

- working in a team to maintain machines and equipment
- communicating with their team to feedback on maintenance outcomes

Self-managers

- working within a timescale that meets the needs of others

Effective participators

- working with others to identify problems.

Level 1 Unit 5: Introduction to engineering materials (ENG1U5)

What is this unit about?

The purpose of this unit is to develop learners' knowledge of engineering materials and, as part of their wider experience of engineering systems and processes, to give them the skills needed for carrying out simple visual and practical tests to determine the properties and applications of materials. The unit will help learners to recognise the importance of specifying a suitable material for the working conditions in which a manufactured product has been designed to operate.

This unit is practically focused. Learners will work with everyday materials and relevant tools and equipment in order to gain an understanding of the principles that link material selection to applications. They will also understand that appropriate materials selection is important in all aspects of engineering. They will learn how to use simple workshop tests to identify the basic material categories and common examples, and engineering applications for materials.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 know and be able to recognise the types and basic properties of engineering materials

2 be able to use simple test equipment and basic test procedures to identify materials and evaluate their properties

3 be able to select suitable materials and forming processes for manufacturing particular products.

Assessment criteria

1 The types and basic properties of engineering materials

The learner can:

a identify materials belonging to each of four basic groups:

- i metals
- ii polymers
- iii natural
- iv ceramics

b identify a range of common engineering materials used in the manufacture of everyday products (IE1):

- i low carbon steels, aluminium/alloys, copper/alloys
- ii polymethyl methacrylate (PMMA), polythene, polyester, polyurethane, acrylic
- iii rubber, wood
- iv glass, concrete, refractory

c make a distinction between ferrous and non-ferrous metals, and between thermoplastics and thermosetting plastics, by comparing the following important properties (IE3):

- i strength
- ii hardness
- iii durability or toughness
- iv thermal and electrical conductivity
- v corrosion resistance or degradability
- vi appearance
- vii weight
- viii ability to be formed and joined.

2 Use simple test equipment and basic test procedures to identify materials and evaluate their properties

The learner can:

a use simple testing or inspection equipment safely to compare the properties of materials (IE2) (SM4):

- i strength
- ii toughness
- iii brittleness
- iv surface finish
- v magnetism
- vi conductivity

b describe basic workshop tests that are used to identify common engineering materials by their properties:

- i visual appearance
- ii surface texture
- iii magnetic
- iv ease of bending
- v density.

3 Select materials and processes for particular engineering applications

The learner can:

a consider the important factors that link common engineering materials to products and specific manufacturing processes, in particular where metals have been replaced by non-metallic materials (IE5):

- i mechanical and physical properties
- ii ease of processing
- iii cost of processing
- iv cost of raw material
- v availability
- vi sustainability

b investigate common everyday products to identify constituent material(s) and the engineering processes used in their manufacture (IE2)

c select and use simple forming processes

d identify situations where the selection of material(s) has been beneficial to either the product or its manufacture (EP4).

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

Before manufacturers can start to make products for sale, they must carry out tests to ensure that the materials used in the manufacture of the products are suitable. In this assignment, learners will complete a practical task which requires them to test a small range of materials, record the testing and make suggestions for the use of the materials and suitable forming processes. This method of assessment allows the learner to apply the knowledge and skills from the unit within a sector related context.

The assignment will take approximately 5 of the 30 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification, and evidence should be kept for moderation purposes.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a testing schedule to identify test method, equipment and materials, and Health and Safety considerations

2 explanations of material properties, possible applications and suitable forming methods

3 records of methods, testing and modifications to processes.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the Assessment criteria topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Use the provided materials and specifications to produce a schedule of tests which will identify the mechanical and physical properties of common engineering materials.
- On the sheet provided, record any observation or data evaluation that occurred when examining the materials or preparing the schedule of tests.
- Produce a list of the appropriate PPE required and any specific safety procedures that should be followed when preparing for and carrying out tests.
- Carry out workshop tests on metallic and non-metallic engineering materials from the following categories:
  - ferrous metal
  - non-ferrous metal
  - thermoplastic polymer
  - natural material
  - ceramic
- Record the test carried out and explain why it was appropriate for the specific material.
- Explain how different tests might have been used to confirm the type of material and its properties.
- Consider and identify factors that could link the materials to products and processes.
- Name a suitable application/forming process for each material.
- Give examples of a use of the material which has been identified.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 The types and basic properties of engineering materials	25%	12
2 Use simple test equipment and basic test procedures to identify materials and evaluate their properties	50%	24
3 Select materials and processes for particular engineering applications	25%	12
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptions in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 The types and basic properties of engineering materials	0 – 4 marks Relied predominantly on one source of information or data. Identified common engineering materials and shown a basic understanding of the different material groups. Identified basic properties of engineering materials.	5 – 8 marks Obtained information from more than one source. Identified a range of common engineering materials and shown a good understanding of the different material groups. Compared the properties of engineering materials across different categories.	9 – 12 marks Collected and used information from a variety of sources. Identified a range of common engineering materials and shown a comprehensive understanding of the different material groups. Compared and described in detail the key properties of engineering materials across different categories.

Assessment criteria topic	Band 1	Band 2	Band 3
2 Use simple test equipment and basic test procedures to identify materials and evaluate their properties	0 – 8 marks Suggested how a single property could be tested. Selected and tested a restricted range of materials with limited accuracy; named the equipment to be used and made limited reference to the properties of the materials. Needed more than one attempt to produce satisfactory test results; the testing of some materials may be incomplete or show poor results. Normally complied with Health and Safety requirements.	9 – 16 marks Identified the range of test equipment and the required recording medium for the tests. Used a range of materials and test equipment to produce suitable results which are within the range recorded in known references; linked the test results to the basic properties of the materials. Completed tests in accordance with the schedule; used test equipment adequately to ensure requirements have been met. Complied with Health and Safety procedures most of the time.	17 – 24 marks Produced a detailed and clear schedule of tests for comprehensive testing. Used a wide range of materials and testing techniques that highlight key differences between materials; completed tests to schedule and recorded all results accurately. Accurately linked the test results to the key properties of the materials. Worked systematically using tools, equipment and testing devices to ensure specification requirements were fully met. Ensured Health and Safety requirements were complied with at all times.
3 Select materials and processes for particular engineering applications	0 – 4 marks Identified a few factors that link common engineering materials to products. Named an application and/or forming process for a common engineering material. Shown a generic understanding of the relationship between products and materials.	5 – 8 marks Identified a range of factors that link common engineering materials to products. Suggested several applications and/or forming processes for common engineering materials. Selected products and made some reference to the properties of the constituent materials.	9 – 12 marks Described a range of important factors that link common engineering materials to products. Suggested applications and forming processes for a wide range of common engineering materials. Selected products that link the specific properties of the materials to the working situation.

Guidance for delivery

This is an active learning unit which allows ample opportunity for learners to become familiar with a limited range of materials that are commonly used in engineering applications.

It is important that learning be directed towards the investigation and testing of common engineering materials that are used in the manufacture of everyday products, such as:

- carbon steel(s)
- aluminium
- brass
- polythene
- polyurethane
- plywood
- rubber.

Investigating products is an ideal way for learners to appreciate that the properties of materials have a significant influence on their selection for particular applications and the process for manufacturing them into products. By examining and testing common metals, polymers and natural materials, learners will gain an understanding of the different characteristics and useful properties of each, and how these factors influence the choice of industrial process used to form products. Investigations can be carried out either individually or as part of group work, but a thorough evaluation and discussion of the data is essential as part of the planned learning programme.

The learner will begin to link basic properties such as strength and toughness, hardness and brittleness, corrosion resistance and appearance, and electrical and thermal conductivity. They will develop an understanding of the relationship between strength and weight, and how this is important to specific sectors of industry. Learners will recognise that the factors governing the selection of a material cannot be viewed in isolation from one another as there is a complex interaction between them, which is dictated by a range of factors associated with design and service requirements such as:

- properties (mechanical, physical)
- ease of processing
- cost (processing)
- cost (raw material)
- availability
- sustainability.

When undertaking this investigation, learners need to use planning techniques which ensure quality outcomes, and to consider Health and Safety issues. They will also create simplified risk assessments.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- workshop or laboratory facilities to enable practical tasks to be undertaken
- simple hand tools, vices, spanners, hammers, chisels and files
- etching reagents
- simple bending apparatus
- bench mounted tensometer
- suitable textbooks, datasheets or information contained on CD-ROM/DVD
- interactive and web-based learning materials.

Opportunities for applied learning

Learners will benefit from visits to companies that are involved in the manufacture of products utilising a range of different materials. Visits will allow learners to understand how the selection of a material for a particular product influences the selection of the process used in its manufacture.

Learners will also gain an insight into the quality assurance and testing side of manufacturing. This will be in addition to the basic workshop tests which are a useful method of understanding material properties. Larger companies that manufacture using more than one engineering process with a range of materials will also be able to provide evidence of product development and improvement through material selection and processing.

Learners should be given the opportunity to use a range of different workshop tests on different materials, and to compare the results with values from known reference sources. These activities will provide learners with experience of following set procedures and using a range of different tools and techniques. This experience will link to the activities required in other activity-based Level 1 units.

What activities might be involved in this unit?

- Recognising materials from which everyday products are made.
- Distinguishing between the different categories of common engineering materials.
- Using simple workshop tests to investigate the properties of common engineering materials.
- Using material forming processes.
- Giving details of the decisive factors that influence the selection of materials for particular applications.
- Recording information and data using appropriate method(s).

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- planning and carrying out tests to ascertain a material's properties
- deciding the relevance of each property to the characteristics of a product or products

Creative thinkers

- comparing the influence of different properties on a material's behaviour
- suggesting alternative materials for investigated products

Reflective learners

- communicating what they have learned using detailed recording methods

Team workers

- working with others during investigations and when discussing test results

Self-managers

- organising time and resources during testing and investigations to ensure that data is in a format which can be compared with known reference sources

Effective participators

- proposing practical ways of examining products to link them to specific materials and their properties.

Level 1 Unit 6: Introduction to electronics (ENG1U6)

What is this unit about?

The purpose of this unit is to provide learners with the opportunity to gain electronic skills and knowledge as part of their wider experience of engineering systems and materials. Electronic technologies are used in many aspects of engineering, and a familiarity with the application of electronic understanding and constructional skills forms is an important quality for engineers.

This is a practically focused unit during which learners will work directly with components, tools and test equipment. They will learn to read and interpret circuit diagrams, understand the identification of components, and know how to build functioning circuits. The learner will also develop an understanding of how prototype electronic circuits are constructed. All of these skills are essential engineering skills used across a number of sectors including electrical, electronic, automotive, aerospace and marine.

Learners must both review their own work and get feedback from others. They should use the review and the feedback to improve their work.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 understand circuit diagrams and select components

2 be able to model, prototype and test circuits using Computer Aided Design (CAD) and prototyping systems

3 be able to build and test electronic circuits, using hand tools and test equipment safely and effectively.

Assessment criteria

1 Understand circuit diagrams and select components

The learner can:

a read, interpret and use circuit diagrams (IE4)

b identify the use of common electrical and electronic components including passive and semi-conductor devices

c select and use components and recognise their application.

2 Model, prototype and test circuits

The learner can:

a prototype or model and test circuits using a variety of means including (IE1, 2) (SM2, 4):

i CAD systems which simulate circuit and component behaviour

ii prototyping systems using protoboards (breadboarding) methods:

- to understand component behaviour
- as part of developing circuit designs.

3 Build and test circuits

The learner can:

a produce production plans for printed circuit board (PCB) manufacture or circuit construction (RL2) (SM2, 3)

b build circuits using wiring or printed circuits using (SM2, 4):

- i hand tools and equipment correctly and safely
- ii etching or milling to produce circuit boards

c use test equipment when building or developing electronic circuits

d use multimeters to check (IE1, 2):

- i continuity
- ii resistance
- iii voltage
- iv current.

Where the assessment criteria show a direct link to an area of the PLTS framework, they are referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

Frequently when designing, constructing or repairing circuits, engineers need to use or produce modified diagrams before carrying out practical tasks such as prototyping or construction. This assignment is intended to allow learners to demonstrate their ability to perform these tasks.

The learner will complete an assignment, which will involve the production planning and construction of a simple circuit, and the recording of any consequent testing.

The assignment will take approximately 3 of the 30 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification, and evidence should be kept for moderation purposes. If it is not practical to keep the electronic circuit, a photographic record should be kept, along with a signed statement verifying that it is the learner's own work.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a production plan including an annotated circuit diagram(s), from the provided circuit schematic, datasheet and components

2 a completed electronic circuit

3 printouts of CAD models of circuits

4 photographic evidence of physically modelled circuits

5 a test report of construction and testing of circuits.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the Assessment criteria topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Using the provided circuit schematic, data sheet and components, produce an amended circuit diagram using CAD, which shows all connections identified with leg numbers or lead functions (eg the base on an NPN transistor).
- On the provided sheet, show how the polarity of each component can be recognised.
- Build the circuit on the provided circuit board.
- Test the circuit and record any test equipment used and the readings obtained.
- Attach any off-board components specified and check the operation of the circuit.
- Record any testing or rectification carried out.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 Understand circuit diagrams and select components	25%	12
2 Model, prototype and test circuits	25%	12
3 Build and test circuits	50%	24
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptions in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 Understand circuit diagrams and select components	0 – 4 marks Attempted to use simple circuit diagrams. Shown a limited understanding of the function of components. Attempted to select some basic components. Identified and used a restricted range of components correctly.	5 – 8 marks Used basic circuit diagrams. Shown an understanding of the function of components. Selected some basic components. Identified and used components correctly.	9 – 12 marks Used basic diagrams very effectively. Shown a comprehensive understanding of the functions of components. Selected specific components for their characteristics. Readily identified and correctly used a wide range of components.
2 Model, prototype and test circuits	0 – 4 marks Modelled simple circuits. Used only one method.	5 – 8 marks Modelled basic circuits using more than one method. Attempted to use more than one method.	9 – 12 marks Produced a range of circuit models including prototyping. Used a range of methods and CAD models to test alternative circuit designs.
3 Build and test circuits	0 – 8 marks Followed a production plan. May have needed more than one attempt to produce a system to a basic standard. Made some attempt at testing. Normally complied with Health and Safety requirements.	9 – 16 marks Attempted to produce a production plan. Used a limited range of components to produce a functioning assembly which met basic quality standards. Used test equipment to carry out simple checks. Complied with Health and Safety procedures.	17 – 24 marks Produced an effective production plan. Used a range of components to produce a circuit that met quality requirements. Used test equipment correctly and effectively to identify faults and check system performance. Shown an active awareness of Health and Safety issues and complied with procedures.

Guidance for delivery

This is an active learning unit, which allows ample opportunity for learners to become familiar with the basic components and electronic devices in use. It is important that learning be directed towards the production and testing of realistic and functioning circuits which could form part of an engineered product.

Modelling circuits provides several advantages for learners as they are introduced to circuits at component level. Using either prototyping or computer modelling methods, circuits can be quickly constructed and tested; the effects of changing component position or value become immediately apparent and learning can progress at a rate which will engage learners. Several software packages exist for this purpose and this is an area of constant development.

Equally, the construction of circuits from prepared printed circuit boards will enable learners to gain experience of industrial practice and will allow them to take part in assembly tasks. This can be carried out individually or as part of group work simulating the work environment. If suitable industrial workplaces are available, then the learner could also experience this first-hand.

When undertaking this work, learners need to use planning techniques which ensure quality outcomes. Any planning should involve consideration of Health and Safety issues, including the creation of simplified risk assessments.

To ensure learners have a complete understanding of the purpose of this work, industrial visits, work placements and the use of visual materials such as DVDs should be used. These will allow learners adequate opportunity to comprehend the size and complexity of electronic manufacturing operations.

Learners need to be able to recognise and use common electrical and electronic components and their symbols, including the following passive and semi-conductor devices:

- resistors fixed and variable including LDR and thermistor
- capacitors
- semi-conductor devices such as transistors; diodes; and integrated circuits including timers, logic and amplifiers
- photo-emissive and photo-detective components, eg LED and LDR
- switches, relays and fuses.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- Suitable textbooks, datasheets or information contained on CD-ROMs and DVDs.
- Design and Make It!: Electronic Products – NelsonThornes.
- Interactive learning materials, including advice available on the Electronics in Schools Initiative **www.electronicsinschools.org**
- Technology Enhancement Programme **www.tep.org.uk**
- Hand tools, soldering equipment and test equipment including multimeters.
- Prototyping boards, prepared circuit boards, etching or circuit milling facilities.
- Circuit simulation software, eg Crocodile Technology, Circuit Wizard.

Opportunities for applied learning

Learners will be able to apply the skills and knowledge gained in this unit by:

- building electronic systems
- fault-finding simple electronic or electrical systems
- incorporating their learning into other more complex tasks involving maintenance or the building of control or instrumentation systems
- participating in engineering activities including competitions requiring this level of electrical/electronic understanding and skill, eg the Toyota Technology Challenge, the 4x4 in Schools Technology Challenge or Greenpower
- using the skills and knowledge of this unit in activities such as robotics construction.

What activities might be involved in this unit?

- Using information from data sheets to produce a circuit diagram.
- Recognising and placing components correctly.
- Building a circuit.
- Showing evidence of planning and testing.

Suggested prior learning

Learners should be familiar with the concepts of simple electrical circuits and have some understanding of voltage and current from their work in KS3 Science or Design and Technology.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- planning and carrying out research when investigating the characteristics of components and circuit behaviour

Creative thinkers

- trying out new ideas when testing and fault-finding circuits

Reflective learners

- reviewing progress against the expectations of the production plan

Team workers

- working with others towards common goals such as completing a set of circuit boards as part of a batch

Self-managers

- ensuring practical work targets are met when building or testing circuits

Effective participators

- proposing practical ways forward, eg planning the order of assembly of a circuit.

Level 1 Unit 7: Engineering the future (ENG1U7)

What is this unit about?

The purpose of this unit is to introduce learners to new developments in engineering technology. The importance of developing new materials and technologies for use in the 21st century and into the future will be investigated, and learners will understand the importance of renewable energy resources and recycling activities.

An important aspect of this unit is to allow learners the opportunity to develop skills in effective participation and teamwork. They will also carry out research and demonstrate presentation and communication techniques.

Much of the content of this unit has value when it involves learners carrying out processes which form part of other units of learning. It is essential therefore that these links are identified and learners are given the opportunity to apply this learning in other contexts.

This unit, alongside the others within the Level 1 Principal Learning in Engineering, has been designed to allow learners the opportunity to develop a range of Personal, Learning and Thinking Skills (PLTS), and to demonstrate these on more than one occasion. This approach will allow them to build towards a full range of PLTS.

Learning outcomes

The learner will:

1 know about developments in new materials and engineering technology

2 understand the environmental issues that relate to engineering including recycling and the disposal of products at the end of their useful life.

Assessment criteria

1 Developments in new materials and engineering technology

The learner can:

a identify new materials and describe their uses, such as:

- i high temperature materials used for:
  - gas turbines
  - jet engines
  - space rockets
- ii metallic foams and cellular materials with wide-ranging uses such as:
  - energy absorption
  - filtration
  - magnetic shielding
  - vibration damping
  - thermal insulation
  - medical implants
- iii biomedical materials such as titanium or stainless steel
- iv structural composites eg carbon fibres
- v shape memory alloys used, for example, in eyeglass frames, medical tools and mobile phone antennae

b identify and describe the development of new technologies such as hybrid car engines, microprocessors and robotics

c carry out research into new materials and technologies, and the uses of both (IE2, 4).

2 Environmental issues

The learner can:

a identify renewable energy resources such as:
   i solar
   ii hydropower
   iii wind power
   iv biofuels
   v fuel cells
   vi chemical and mechanical energy storage

b investigate and describe the effects of energy generation on the environment, such as:
   i energy loss
   ii carbon emissions

c explain how engineering products are disposed of at the end of their useful life, and the methods used to recycle materials and reduce waste

d work with others on projects which involve the use of renewable and sustainable energy sources:
   i allocating roles (TW3)
   ii working towards common goals (TW1)
   iii providing constructive support and feedback to others (TW6)

e suggest ways of recycling or disposing of materials used in engineering products (CT1, 2)

f present their findings to others (RL6) (EP2).

Where the assessment criteria show a direct link to an area of the PLTS framework, it is referenced here. Further information on PLTS is available in Section 3.1 of this specification and also within this unit in the section on Personal, Learning and Thinking Skills.

Guided learning hours

It is recommended that a minimum of 30 guided learning hours be spent on this unit.

Assessment

This unit is assessed through a centre set and marked assignment. Internal assessments are subject to moderation by AQA-City & Guilds.

Learners will complete an assignment which involves investigation and research into one new engineering product which must include the use of new materials or technologies as part of its construction or function. When researching the new product, they will investigate:

- new materials and technology that are used as part of the product, eg for replacing traditionally used materials, or adding intelligence or responsiveness to products, or by exploitation of a unique property possessed by the material.
- the use of renewable energy resources which could be used when producing the product
- the effects of energy generation on the environment
- how the materials used to make the engineering product could be disposed of at the end of their useful life.

Learners will work in small teams when researching the use of renewable and sustainable energy sources. They should plan the team's work activities and allocate roles. Learners will complete the assignment individually and present an aspect of their investigations. They should also produce a short summary of their teamworking experience, explaining the factors that have contributed to the success of the team.

If all, or part of, the evidence produced by a learner relates to outcomes produced as a result of working in a group, it must be clear which evidence is to be credited to the individual learner.

The assignment will take approximately 15 of the 30 guided learning hours available for this unit. The learner should work under controlled conditions in accordance with the guidance in Section 4.4 of this specification. The gathering of material can take place outside of the controlled environment, but all submitted work must be prepared under supervision. Evidence should be kept for moderation purposes and the presentation should be submitted as a written transcript, video evidence or recording.

Evidence requirements

The learner must produce evidence of achievement of the assessment criteria. In the assignment, the learner will produce:

1 a summary of the investigation into a new product which uses new materials and technology

2 an information chart showing different renewable energy sources and the effects of energy generation on the environment

3 an evaluation of their teamworking experience

4 a presentation on one aspect of disposal or recycling.

In order to attain a high mark in this unit, learners must address all of the above. It may, however, be possible to achieve a pass mark without producing every one of the evidence requirements. A table showing how the Assessment criteria topics are weighted is included below, and learners should be shown this in order that they understand how the final mark is determined.

Assignment structure

A suggested assignment structure, which would allow learners to meet the evidence requirements, may include the following steps:

- Consider a modern engineering product. Using appropriate resources, research the new materials and technology used to design and construct the new product.
- Produce a summary of the investigation, identifying the uses of new materials and technology.
- Working in teams, plan the team's activities and allocate roles in order to research renewable and sustainable energy sources.
- Produce an information chart which would allow a designer to select from different energy sources. On the chart, rate how sustainable each source is and give reasons for the rating. Include the effects of energy generation on the environment.
- Produce an evaluation on the teamworking experience.
- Design and give a presentation on how, in a sustainable way, engineering materials of the sort used in the manufacture of engineering products can be disposed of safely or reused.

For example, learners could investigate a product such as an electrically powered bicycle.

Weighting of assessment criteria topics

Assessment criteria topic	Weighting	Marks
1 Developments in new materials and engineering technology	50%	24
2 Environmental issues	50%	24
Total	100%	48

Assessment grid

This statement of performance should be read in association with the assessment criteria for this unit.

Please note that the descriptions in this marking grid relate to the top of each band. Further guidance on using marking grids is available in the Assessment section of this specification.

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
1 Developments in new materials and engineering technology	0 to 8 marks Relied on easily obtainable information to describe a limited range of new materials and technologies, and their uses. Considered a new material or technology, and how it might be used, giving simple reasons for any choices made.	9 to 16 marks Collected and used relevant information from, a variety of sources, on new materials and technologies and their uses. Described the advantages of using new materials or technologies for a particular purpose; provided a valid reason for the choice made.	17 to 24 marks Produced a detailed and informative summary using a wide range of information and media; included relevant information on a wide range of new materials and technologies. Described the use of new materials and technologies, giving reasons for the adoption of the new material or technology; explained the advantages this adoption of new materials or technologies provides for the operation of the product.

Assessment grid (continued)

Assessment criteria topic	Band 1	Band 2	Band 3
	The learner has:		
2 Environmental issues	0 to 8 marks Made some suggestions for energy generation or storage which were predominantly related to the limited use of a single technology. Mentioned sustainable systems with limited accuracy. Considered disposal or recycling issues. Made a contribution to the group's research and produced a basic evaluation of their personal performance as a team member. Produced a simple presentation, attempting to use some information gained by group research.	9 to 16 marks Considered a range of alternative solutions for energy generation or storage; based their choices on well informed research. Made choices when considering materials to ensure sustainability. Explained the processes used for the recycling or disposal of materials. Made an effective contribution to the group's research and produced an adequate evaluation of their personal performance as a team member. Produced an effective presentation which used some information gained by group research.	17 to 24 marks Considered and used information from a variety of sources; researched and compared several energy sources; adequately justified any decisions for the choice of energy source. Clearly considered alternative energy sources to ensure sustainability. Proposed several ways of disposing of materials at the end of their useful life. Made an important and effective contribution to the group's research and produced an effective evaluation of their personal performance as a team member. Produced a detailed and informative presentation; made good use of the information gained by group research.

Guidance for delivery

This unit will provide learners with the opportunity to learn about the use of new materials and technologies, while at the same time considering the impact on the environment. It may therefore be possible to integrate the teaching of this unit with other Level 1 units, and in doing so, many of the ideas developed by this unit can be further explored. Alternatively, this unit could provide a number of integrating themes which allow learners to work together using the content of units previously studied.

This unit particularly lends itself to co-teaching with Level 1 Unit 1: Introducing the world of engineering, but several aspects of the unit such as new and emerging materials could be incorporated into other units such as Level 1 Unit 2: Practical engineering and communication skills, or Level 1 Unit 5: Introduction to engineering materials. Projects which address the problems of renewable or alternative energy can be attempted in other units and will build upon the work covered in this unit.

Engineering products containing examples of new materials or technology can be drawn from a variety of sectors.

Materials such as titanium, used for both strength and weight, and high temperature ceramics used in high performance engines, can be considered. Composite materials such as carbon fibre or Kevlar® used in racing car and boat construction for body parts and hulls are also suitable examples.

Interesting new developments seem to occur almost monthly with hazardous materials such as glass being replaced by polymers or modified by self-cleaning or anti-glare coatings. Examples include the increasing use of polymers such as ABS to replace metallic parts for high volume production or for low impact speed bumpers on cars. The use of thermo-chromic strips on engine parts or computer casings for detecting higher than normal operating temperatures could also be investigated.

Another important aspect is the increasing use of semiconductor devices based on silicon which allows intelligent products to be produced with ever increasing power and at lower cost. Providing learners with first-hand experience of these materials and technologies will add considerably to understanding.

Learners will develop an understanding of renewable energy resources along with the effects that energy generation can have on the environment. Through their work in this unit, learners will also become aware of the environmental and social impacts of engineering, particularly with regard to the use of materials and recycling. In particular they should consider the merits and disadvantages of the different systems used for disposal, reuse or recycling of products.

The following are some resources that may facilitate or enhance the learning covered in this unit:

- workSMART www.worksmart.org.uk
- Technology Enhancement Programme www.tep.org.uk
- The Centre for Alternative Technology www.cat.org.uk
- Intermediate technology www.itdg.org.uk
- Environmental care www.envocare.co.uk
- How stuff works www.howstuffworks.com
- Wikipedia article: Wind turbine http://en.wikipedia.org/wiki/Wind_turbine
- Channel4: Clipbank Design and Technology

Opportunities for applied learning

Central to this unit are many issues which will affect industrialised societies in the near future. Learners will be able to apply the knowledge gained in this unit to a variety of projects and issues concerned with the environmental aspects of engineering. Learners will also explore new and exciting aspects of engineering technology, design and materials which improve their quality of life.

The study of new products and technologies, consideration of issues undertaken by the examination of new products, and visits to industrial sites will enhance the learner's understanding of the impact of engineering in the 21st century and into the future.

When studying renewable energy resources and investigating the effects of energy generation on the environment, learners could work in small groups. By temporarily damming streams for mini-hydro energy generation, building small-scale wind turbines, or building devices to sort materials or reduce the bulk of waste, learners will gain first-hand experience of how engineering can be used to provide solutions.

3

What activities might be involved in this unit?

- Visiting an engineering centre that deals with new materials or technologies.
- Researching and investigating aspects of modern engineering or energy use before making a presentation.
- Visiting a recycling centre.
- Working in teams on projects using new materials, alternative energy generation or recycling.

Personal, Learning and Thinking Skills

The list below is indicative of the way this unit supports the development of PLTS, as opposed to the achievement of PLTS that are possible through the assessment. The unit supports the development of more PLTS than are covered through the assessment criteria alone. There will be opportunities within the unit for collaborative work which will provide opportunities to develop teamworking skills.

Alternative approaches could be selected.

The learner could develop PLTS by:

Independent enquirers

- planning and carrying out research on the uses of engineering materials and technology
- researching the recycling of engineering products
- analysing and evaluating the information obtained as a part of the research process
- judging the relevance and value of the information obtained before deciding on its use

Creative thinkers

- generating ideas on methods of presentation of information obtained
- asking questions on topics being investigated to further develop ideas

Reflective learners

- setting goals on the achievement of the tasks required to carry out the research
- inviting feedback from peers and teachers and reviewing progress on the research
- communicating their learning to meet audience requirements

Team workers

- providing constructive support and feedback to others by offering hints and advice

Self-managers

- working towards goals and organising time and resources to meet these goals

Effective participators

- identifying improvements in, for example, the use of recycling that would benefit others.

4 Assessment

4.1 Aims

Diploma courses based on this specification should encourage learners to:

1 develop a broad understanding and knowledge of the Engineering industries

2 develop skills in the broad context of the Engineering industries

3 understand the contribution engineering makes to modern life

4 apply:

- 4.1 Functional Skills at Level 1 in Mathematics, English and ICT
- 4.2 transferable Personal, Learning and Thinking Skills (PLTS) in independent enquiry, creative thinking, reflective learning, team working, self-managing and effective participation
- 4.3 investigative and project management skills through a Diploma project
- 4.4 skills gained through work experience

5 learn through experience of applying knowledge and skills to tasks or contexts including those that have the characteristics of real work, eg the minimum 10 days' work experience, including:

- 5.1 planning and reflecting on their experience
- 5.2 drawing out and articulating lessons learnt
- 5.3 applying their learning to new activities or situations.

4.2 National criteria

This Principal Learning Engineering specification complies with the following:

- Criteria for the specialised Diploma qualifications in engineering at levels 1, 2 and 3 (published QCA November 2006)
- Criteria for the accreditation of Diploma qualifications at levels 1, 2 and 3 (published QCA April 2007)
- Operating Rules for Component and Diploma awarding bodies version 1.0 (published QCA 2007)
- The Arrangements for the Statutory Regulation of External Qualifications in England, Wales and Northern Ireland: Common Criteria (published QCA 2004)

4.3 Prior learning

There are no prior learning requirements.

4.4 Internal assessment

Internally assessed units will comply with the Joint Council for Qualifications Instructions for conducting coursework/portfolios – please see JCQ website:
http://www.jcq.org.uk

Task setting

Clear guidance, with exemplars of suitable internal assessment, is available to all consortia centres in order to ensure that suitable tasks are set. AQA-City & Guilds will give guidance on task setting and the moderator will review a selection of proposed tasks to check that they are suitable at the early advisory visits.

The teacher at a centre with overall responsibility for internal standardisation is also responsible for the standardisation of task setting.

Guidance is provided on the total amount of time that a task should take, on the amount of time that specific activities within a task should take and on the form of supervision expected.

Control criteria for tasks

The internally assessed assignments are to be taken under controlled conditions and the forms of evidence required in each unit will drive the controls needed. Where specific guidance is required, it will be found in the assessment section of the unit concerned. The following controls should be in place where appropriate for individual tasks.

Activity – A video or DVD recording of the activity, or a witness testimony describing the activity, will be necessary as evidence of ephemeral work.

Research of relevant sources of material – A bibliography or list of sources eg museums, businesses, organisations, websites will provide evidence of research. The teacher may also question learners on their research and submit signed notes from these questions as evidence.

Record of interviews with business, industry or third party representatives – Transcripts or audio recordings (if permitted by the individual concerned), or the learner's own record of the interview and evidence of permission or observation or witness statement by an observer may be used as evidence of interactions with learners.

Outcome or production – Where this is produced over time, it is possible that the teacher may not supervise the whole of the process, however, sufficient supervision must take place to ensure that the material for assessment is the unaided work of the learner. Photographs, recordings and witness testimony can also be utilised to confirm that the work belongs to an individual learner.

Practical assignment – These must be conducted under supervision and the outcome should be submitted for moderation if possible.

Portfolio of evidence – This must be submitted for moderation.

The above controls are summarised for reference in the following table.

Form of evidence	Method of control								
	Video/DVD recording	Photographs	Witness statement	Bibliography or list of sources	Signed notes evidencing questions asked by teacher	Transcript or audio recording	Learner's own record	Supervision	Submission of artefact or product
Activity	1		2						
Research of relevant sources of material				1	2				
Record of interviews with business, industry or third party representatives			2 with learner's own record			1 with evidence of permission	2 with witness statement		
Outcome or Production	2	2	2			2		1*	1*
Practical assignment	2	2	2			2		1*	1 if possible
Portfolio of evidence									1*

Please note:

Control methods rated 1 are the most preferable type to be used. Those rated 2 may be used if employing the favoured method is not practical, or as a way of providing additional evidence of the learner having met the assessment criteria.

* Where the number 1 is followed by an asterisk, this indicates that any other control method may accompany but not substitute the use of this method.

Guidance by the teacher

The work assessed must be solely that of the learner. Any assistance given to an individual learner which is beyond that given to the group as a whole must be recorded.

Unfair practice

At the start of the course, the supervising teacher is responsible for informing learners of the AQA-City & Guilds Regulations concerning malpractice. Learners must not take part in any unfair practice in the preparation of work to be submitted for assessment, and must understand that to present material copied directly from books or other sources, without acknowledgement, will be regarded as deliberate deception. Centres must report suspected malpractice to AQA-City & Guilds.

Applying the assessment grid

When assessing learners' work, teachers/assessors should consider the level of attainment demonstrated in four broad areas within the demands and context of the specific unit being assessed:

- the depth and breadth of understanding
- the level of skills
- the level of synthesis, analysis and evaluation
- the level of independence and originality.

In the assessment grid for each unit, mark ranges are specified for each assessment criteria topic. When assessing a learner's work, teachers/assessors should use their professional judgement to identify for each assessment criteria topic, the mark band description within which that work falls and then the mark within that range that best describes the depth and quality of the work.

To achieve the higher mark bands, learners should show greater depth and breadth of understanding, higher level skills, higher levels of synthesis, analysis and evaluation and higher levels of independence and originality as required in the assessment criteria. Work that clearly meets all the requirements of the mark band description should be awarded the maximum mark identified.

Aspects of the work that might fall short of meeting, in full, the description but which do not, in the judgement of the teacher/assessor, sufficiently influence the overall level of achievement to merit the work being assigned to a lower mark band, will reduce the mark awarded within the identified range available. This can be expressed as identifying the 'best-fit' approach, where the areas of strength in the work submitted by the learner can be allowed to compensate for weaknesses in other areas.

Assessors will use archived exemplars as they become available as a reference point. By comparing their own learners' work with archive work which has an assessment commentary attached, the assessor will be able to position the work either on a higher or lower point.

Assessment of group work

Group work is a useful way of obtaining information for some activities but it is important that individual learners meet the assessment criteria requirements. Teachers/assessors assessing the evidence will need to be convinced of its individual authenticity. Questioning can be used in order to clarify the validity, authenticity and sufficiency of evidence and, under these circumstances, the teacher/assessor may wish to include a dated witness statement detailing this evidence. It is expected that the use of such statements will be kept to a minimum, so that they constitute a very minor part of the submitted evidence.

Annotation of written/photographic evidence can also be used to detail an individual's contribution.

It is recognised that there can be instances where learners are required to carry out tasks as part of a group and that group-working skills are an integral part of the assessment requirements. In such cases this general guidance on group work will be superseded by the specific requirements and instructions of the individual unit(s).

Internal standardisation of marking

The centre is required to standardise the assessment across different teachers and teaching groups, within and across units, to ensure that all work at the centre has been judged against the same standards. If two or more teachers are involved in marking units, one teacher must be designated as responsible for internal standardisation.

Common pieces of work must be marked on a trial basis and differences between assessments discussed at a training session in which all teachers involved must participate.

The teacher responsible for standardising the marking must ensure that the training includes the use of reference and archive materials such as work from a previous year or examples provided by AQA-City & Guilds.

4.5 Supervision and authentication of internally assessed work

The Head of Centre is responsible to AQA-City & Guilds for ensuring that internally assessed work is conducted in accordance with AQA-City & Guilds instructions and JCQ instructions.

In order to meet the regulators' Operating Rules for Component and Diploma Awarding Bodies, AQA-City & Guilds requires:

- **learners** to sign the record form to confirm that the work submitted is their own, and
- **teachers/assessors** to confirm on the record form that the work assessed is solely that of the learner concerned and was conducted under the conditions laid down by the specification
- **the teacher/assessor responsible for internal standardisation** also to sign the Centre Declaration Sheet (CDS) to confirm that internal standardisation has taken place and that the work presented is that of the learners named. If only one teacher has undertaken the marking, that person must sign this form.

The completed record form must be attached to each learner's work and the Centre Declaration Sheet must be sent to the moderator. Failure to sign either or both the record form and the CDS may delay the processing of the learners' results.

The teacher should be sufficiently aware of the learner's standard and level of work to appreciate if the work submitted is beyond the ability of the learner.

In most centres teachers are familiar with learners' work through class and assignments. Where this is not the case, teachers should make sure that all internally assessed work is completed under direct supervision or controls listed in Section 4.4.

In all cases, some direct supervision is necessary to ensure that the work submitted can be confidently authenticated as the learner's own.

If it is believed that a learner has received additional assistance and this is acceptable within the guidelines for the internally assessed units, the teacher/assessor should award a mark which represents the learner's unaided achievement. The authentication statement should be signed and information given on the relevant form.

If the teacher/assessor is unable to sign the authentication statement for a particular learner, then the learner's work cannot be accepted for assessment.

4.6 Malpractice

Teachers should inform learners of the JCQ Regulations concerning malpractice.

Learners must not:

- submit work which is not their own
- lend work to other learners
- allow other learners access to, or the use of, their own independently-sourced material (this does not mean that learners may not lend their books to another learner, but learners should be prevented from plagiarising other learners' research)
- include work copied directly from books, the Internet or other sources without acknowledgement or an attribution
- submit work typed or word processed by a third person without acknowledgement.

These actions constitute malpractice, for which a penalty (eg disqualification from the examination) will be applied.

If malpractice is suspected, the Examinations Officer should be consulted about the procedure to be followed.

Where suspected malpractice in internally assessed work is identified by a centre after the learner has signed the declaration of authentication, the Head of Centre must submit full details of the case to AQA-City & Guilds at the earliest opportunity. The form, JQM/M1, should be used. Copies of the form can be found on the JCQ website:
http://www.jcq.org.uk

Malpractice in internally assessed work discovered prior to the learner signing the declaration of authentication need not be reported to AQA-City & Guilds, but should be dealt with in accordance with the centre's internal procedures. AQA-City & Guilds would expect centres to treat such cases very seriously. Details of any work which is not the learner's own must be recorded on the cover sheet or other appropriate place.

4.7 Moderation

AQA-City & Guilds will ensure that in consortia where learners from more than one centre are taught and assessed together, a single moderator for each line of learning will be appointed subject to consideration of workload.

Moderation of internally assessed work will take place in two stages and the same moderator will be responsible for each.

Stage 1 – a visit from a moderator representing AQA-City & Guilds at a fairly early stage during the delivery of Principal Learning

The moderator will inspect some work and check such matters as:

- task setting against assessment criteria
- understanding of controlled conditions
- taking and marking of internal assessments
- arrangements for internal standardisation
- coverage of PLTS
- coverage of Applied Learning.

The moderator will give advice, feedback and guidance on each of the above. Stage 1 will be seen as a technical advisory visit and will cover the Principal Learning units.

Stage 2 – a check by the moderator on the taking and marking of samples of Principal Learning units

Internally assessed work will normally be reviewed at the centre but may be sent to the moderator. The samples to be moderated will be agreed with the centre for each identified unit in accordance with the moderation procedures. During the moderation visit, the moderator will normally assess samples of work with the teacher and discuss the standards in order to ensure that they are in line with the national standards for this qualification. If necessary, further samples may be requested and adjustments may be applied to the centre's marks. Mark adjustments will normally preserve the centre's order of merit, but if major discrepancies are discovered, AQA-City & Guilds reserves the right to alter the order of merit.

Centre marks for all units must be submitted to AQA-City & Guilds and to the moderator by the specified deadline **(see http://www.aqa.org.uk/deadlines.php)**. Claiming and moderation of internal assessment is only available in the summer term.

Further details will be given in moderation procedures documentation to be issued by AQA-City & Guilds.

4.8 Post-moderation procedures

On publication of the results for Principal Learning units, AQA-City & Guilds will provide centres with details of the final marks for the internally assessed units.

The learners' work will be returned to the centre after moderation has taken place. The centre will receive a report with, or soon after, despatch of published results giving feedback on the appropriateness of the task set, the accuracy of the assessments, and the reasons for any adjustment to the marks.

AQA-City & Guilds reserves the right to retain some learners' work for archive or standardising purposes.

4.9 Retaining evidence and re-using marks

The centre must retain the work of all learners for each internally assessed unit, with record forms attached, under secure conditions, from the time it is assessed, to allow for the possibility of an enquiry about results. The work may be returned to learners after the deadline for enquiries about results. If an enquiry about a result has been made, the work must remain under secure conditions in case it is required by AQA-City & Guilds.

4.10 External assessment

The external assessments will be timetabled twice a year, in January and June, and the dates will be published at the start of the academic year.

4.11 Factors affecting individual learners

Teachers should be able to accommodate the occasional absence of learners by ensuring that the opportunity is given for them to make up missed assessments.

If work is lost, AQA-City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform AQA Candidate Support of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. If the move occurs early in the course, the new centre should take responsibility for assessment. If it occurs late in the course it may be possible to arrange for the moderator to assess the work through the 'Educated Elsewhere' procedure. Centres should contact AQA-City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

5 Administration

5.1 Availability of Principal Learning units

All internally assessed Principal Learning units for this specification are available once a year only, commencing in June 2009. External assessments will be timetabled twice a year, in January and June, and the dates will be published at the start of the academic year.

5.2 Centre registration

Centres wishing to prepare learners for this specification should apply for approval to offer Principal Learning before teaching begins. Completed application forms should be submitted to Centre Registration, AQA, Stag Hill House, Guildford, Surrey, GU2 7XJ. Applications can only be considered from centres which have received approval through the Gateway process to offer Level 1 Engineering Principal Learning. Further details of the approval process are available on the website at:
http://www.diplomainfo.org.uk

5.3 Centre requirements

Resources

Centres must have access to sufficient equipment in the centre or in other centres within the consortium to ensure that learners have the opportunity to cover all the practical activities. Any requirement for specialised equipment is to be found in the description of the units themselves.

Health and safety

The importance of safe working practice and the demands of the Health and Safety at Work Act 1974 must be stressed to all learners. Learners have responsibilities for maintaining the safety of others as well as their own. Anyone behaving in an unsafe fashion must be stopped and a suitable warning given by the teacher responsible. It is essential that all learners acquire habits required to promote health and safety in the workplace and that their learning avoids potentially unpleasant or dangerous consequences.

Centre staff

Centre staff should be technically competent in all the areas for which they are delivering education and training and/or should also have relevant experience of providing the necessary practical training.

Continuing Professional Development (CPD)

Centres are expected to support their staff in ensuring that their knowledge and skills in the vocational area remain current and take account of any national or legislative developments.

5.4 Entries

Please refer to the current version of Entry Procedures and Codes for up-to-date entry procedures. You should use the following entry codes for the Principal Learning units:

Unit 1 (ENG1U1)

Unit 2 (ENG1U2)

Unit 3 (ENG1U3)

Unit 4 (ENG1U4)

Unit 5 (ENG1U5)

Unit 6 (ENG1U6)

Unit 7 (ENG1U7)

5.5 Quality assurance

Internal quality assurance

Registered centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre registration by AQA-City & Guilds and the centre's and/or consortium's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and AQA-City & Guilds is responsible for external quality assurance.

National standards and rigorous quality assurance are maintained by the use of:

- AQA-City & Guilds external examinations
- AQA-City & Guilds externally set briefs or assignments
- internal quality assurance
- AQA-City & Guilds external moderation.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- the setting of appropriate tasks (see Section 4.4)
- the application of appropriate control of tasks (see Section 4.4)
- training in the use of the assessment grid (see Section 4.4)
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place (see Sections 4.4 and 4.5)
- the completion by learners and teachers/assessors of the record form for each learner's work (see Section 4.5).

External quality assurance

External quality assurance is provided by the two stage moderation system described in Section 4.7. External moderation of internally assessed work is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres and that national standards are maintained.

In order to carry out their quality assurance role, external moderators must have appropriate teaching and vocational knowledge and expertise. AQA-City & Guilds will appoint external moderators and will ensure that they attend regular training and development meetings designed to keep them up-to-date, to ensure standardisation of all assessments and to share good practice.

External moderators:

- provide advice and support to staff in centres
- ensure the quality and consistency of assessments within and between centres and over time by the use of systematic sampling
- regularly visit centres to ensure that they continue to meet the centre registration requirements of AQA-City & Guilds
- provide feedback to centres and to AQA-City & Guilds.

In order to monitor compliance with JCQ requirements, particularly for administering external tests, JCQ inspectors will regularly visit centres.

AQA-City & Guilds requires the Head of Centre to:

1 facilitate any inspection of the Centre which is undertaken on behalf of AQA-City & Guilds

2 make secure arrangements to receive, check and keep examination material secure at all times, maintain the security of AQA-City & Guilds confidential material from receipt to the time when it is no longer confidential and keep scripts secure from the time they are collected from the candidates to their despatch to AQA-City & Guilds.

5.6 Irregularities

Centres must inform AQA of any irregularity, including any candidate who arrives late for a test. For detailed instructions please refer to the current JCQ Instructions for Conducting Examinations which is available to view or to download from the JCQ's website:
http://www.jcq.org.uk

5.7 Awarding grades and reporting results

The Level 1 Engineering Diploma will be reported on a three-grade scale: A*, A and B. Learners who fail to reach the minimum standard for grade B will be recorded as U (Unclassified) and will not receive a qualification certificate.

The Principal Learning and Level 1 Project will be graded separately and will use the same grading system as the Diploma. Principal Learning and the Level 1 Project will be separately certificated but learners will not receive individual certificates for units of Principal Learning.

5.8 Certification of the Diploma

AQA-City & Guilds is a registered Diploma Awarding Body and will certificate the Diploma in accordance with the requirements and timetable to be published separately by QCA. AQA conducts the administration of the Principal Learning units for this specification on behalf of AQA-City & Guilds.

5.9 CABs, DABs and the Diploma aggregation service

AQA is recognised as a Component Awarding Body and offers the widest range of GCE and GCSE qualifications of any unitary awarding body in the UK. These are listed in QCA's Diploma Catalogue. Similarly, City & Guilds is recognised as a Component Awarding Body and offers the widest range of NVQ, VRQ and City & Guilds' own brand qualifications, which are listed in QCA's Diploma Catalogue.

AQA-City & Guilds has been recognised as a Component Awarding Body to certificate Engineering Principal Learning and Project qualifications for Diplomas.

AQA-City & Guilds has been recognised as a Diploma Awarding Body by QCA in order to certificate whole Diploma qualifications for the Engineering Diploma at all three levels.

Learners who have registered for Diploma awards with AQA-City & Guilds will on completion receive a Diploma certificate and a Diploma transcript. The transcript will conform to QCA's specification in terms of the design and information included. The data for the transcript will be supplied by the Diploma aggregation service which is designed to enable the data sharing, results aggregation and grading supporting functions required for the operation of the Diploma as a composite qualification.

5.10 Enquiries about results

The services available for enquiries about results include a clerical check, re-mark of external assessments and re-moderation of internally assessed work. Requests must be submitted within the specified period after the publication of results for individual assessments.

In cases where a post-results enquiry reveals inaccurate assessment, the result may be confirmed, raised or lowered.

For further details of enquiries about results services, please consult the current version of the JCQ *Post-Results Services booklet*.

5.11 Re-sits and shelf-life of unit results

Unit results remain available to count towards certification, whether or not they have already been used, as long as the specification is still valid.

Learners may re-sit a unit any number of times within the shelf-life of the specification. The best result for each unit will count towards the final qualification.

Learners will be graded on the basis of the work submitted for assessment.

5.12 Access arrangements and special consideration

We have taken note of the provisions of the Disability Discrimination Act (DDA) 1995 in developing and administering this specification.

We follow the guidelines in the Joint Council for Qualifications (JCQ) document: *Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examination GCSE, GCE, GNVQ, AEA, Entry Level, Basic Skills & Key Skills Access Arrangements and Special Consideration*. This is published on the JCQ website:
http://www.jcq.org.uk/access_arrangements/
or you can follow the link from our website:
http://www.aqa.org.uk/admin/p_special_3.html

Access arrangements

We can make arrangements so that learners with disabilities, special educational needs and temporary injuries can access the assessment. These arrangements must be made **before** the examination. For example, we can produce a Braille paper for a learner with visual impairment.

Special consideration

We can give special consideration to learners who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given **after** the examination.

Applications for either access arrangements or special consideration should be submitted to AQA-City & Guilds by the Examinations Officer at the centre.

5.13 Language of examinations

We will provide units for this specification in English only.

5.14 Qualification titles

The qualification based on this specification is:

AQA-City & Guilds Level 1 Principal Learning in Engineering.

Appendix A

Connections to other qualifications

The Level 1 Engineering Diploma incorporates the following qualifications:

1 Functional Skills qualifications in English, Mathematics and ICT

For details of the AQA Functional Skills specifications please go to:
http://www.aqa.org.uk/qual/gcse/functional_skills.php

For details of the City & Guilds Functional Skills specifications please go to:
http://www.cityandguilds.com/functionalskills

2 The Level 1 Project qualification

For details of the AQA-City & Guilds Level 1 Project specification please go to:
http://www.diplomainfo.org.uk/aboutdiplomas/projects.html

Appendix B

Additional and Specialist Learning for the Level 1 Engineering Diploma

The complete list of accredited qualifications which has been recognised as eligible for Additional and Specialist Learning for the Level 1 Engineering Diploma is published on the National Database of Accredited Qualifications. Visit:
http://www.accreditedqualifications.org.uk

AQA and City & Guilds qualifications which have been recognised as eligible for Additional and Specialist Learning for the Engineering Diploma are also published on:
http://www.diplomainfo.org.uk

Appendix C

Other issues

European Dimension

AQA-City & Guilds has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen units.

Environmental Education

AQA-City & Guilds has taken account of the 1988 Resolution of the Council of the European Community and the Report *Environmental Responsibility: An Agenda for Further and Higher Education* 1993 in preparing this specification and associated specimen units.

Avoidance of Bias

AQA-City & Guilds has taken great care in the preparation of this specification and specimen units to avoid bias of any kind.