



**General Certificate of Secondary Education  
June 2012**

**Engineering (Double Award) 48502**

**(Specification 4850)**

**Unit 2: Internal Assessment**

***Report on the Examination***

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## General Comments

It is pleasing to report how successful the coursework moderation for this specification has been. The majority of teachers were correct in their interpretation of the assessment grids and few adjustments were necessary. Those centres that are new to this specification or have new teachers delivering the engineering course are advised to make use of the Teacher online materials (TOLS) available on eAQA and make contact with their coursework adviser.

To be successful in this subject, students need to show evidence of both their design and making skills. Centres chose a variety of approaches with an even split between those that designed and made one product and those that designed and made separate products. A variety of the controlled assessment tasks were attempted. As centres are not visited to assess practical work, centres should present photographs and annotation to reinforce marks awarded. Several centres submitted work electronically that in some cases included videos of work being evaluated. This was not only interesting but hopefully proved very motivating for the students. This approach is to be encouraged.

For students to achieve marks in Band 3 moderators were looking for an increasing depth and breadth of understanding; increasing coherence, comparison against the specification and drawing of valid conclusions. Students should be working with increased independence and originality.

## Teacher Annotation

Centres must submit photographs of the practical outcomes and annotate the candidate record sheet. If photographs are not submitted, the marks are likely to be adjusted. Moderators have been asked to contact centres that do not submit photographic evidence and ask for it to be sent. Teacher comments are very useful, being used by the moderator to confirm why a particular mark was awarded. In addition to these two requirements centres are also asked to submit photographs of work in progress and give a breakdown showing the **breakdown of marks for each criterion**.

It would be most useful that teacher annotation details and states exactly what a student has done and how this meets specified assessment criteria. General statements such as 'worked within normal workshop rules' is not sufficient to provide evidence of independent use of appropriate processes, tools and equipment, using them safely with skill and accuracy. It would be more useful to give specific examples when the candidate has considered health and safety, set up, and used a particular piece of equipment unaided. Other forms of evidence such as annotated photographs, records of QC and QA in production plans, would also support teacher annotation.

## Administration

The moderation time period is extremely tight and, although the moderation process was relatively trouble free, centres are thanked for their contribution. There are a number of areas, which need attention.

- Centres are reminded that Centre Mark Sheets need to be with AQA and the moderator no later than the 5th May. Centres must remember that moderators themselves have strict deadlines to adhere to.
- Centres with twenty or fewer candidates should include all coursework folders when sending the Centre Mark Sheets to the moderator.
- Centres need to complete a Centre Declaration Sheet and send this to the moderator.

- Each candidate requires a completed Candidate Record Form, these should be secured to the front of each portfolio or be included with the folders when sent to the moderator.
- Portfolios should be individually fastened together in a logical order, to assist the moderation process. Each student's work (parts A, B and C) is marked by the same moderator so should be presented in one folder. It is the centre's responsibility to present candidates' work in the best possible manner for moderation to ensure their potential is achieved. Multiple folders do not make the moderation easy and can cause confusion.
- Although no specific paper size is recommended by AQA, centres are asked to use what they consider to be most appropriate. Some centres used a mix of A4 and A3 and fold each of the A3 sheets when binding, other centres use plastic wallets that contain a large numbers of loose sheets. This makes moderation particularly difficult and more time consuming than necessary.
- When assessing students' work reference should be made at all times to the Assessment Evidence Grids. It is from these grids that the moderator checks criterion marks and arithmetic. **Centres are asked to show how the final mark has been obtained.**

## Assessment of Unit 2

The completion of Part A and B can take a variety of forms, as was evident from the work presented for assessment. Approximately half the centres taught the two sections separately with no link between the controlled tasks tackled. Whereas in a number of centres the students designed the engineered product in their part A work and went onto make it for part B. Both approaches have advantages and disadvantages; it is for the centre to decide what is most appropriate for their circumstances. Most of the Controlled tasks were attempted by some students with the Can crusher and ladder tool holder being particularly popular.

When making assessments the three mark bands in the grid indicate that a candidate has shown:

- Increasing depth and breadth of understanding;
- Increasing coherence, comparison against the specification and drawing of valid conclusions;
- Increasing independence and originality.

Through their work, students should be given opportunities to show these abilities.

When awarding marks in the higher mark bands, the following should be considered.

- Range of ideas
- Alternative solutions considered and reasons for choice explained.
- Alternative methods of making explored and reasons given for choice
- Number of making processes considered with advantages and disadvantages given.
- Presentation of the portfolio in an increasing logical manner.
- An outsider could follow the design choices and make the product from the information given.
- Comparison of the design solutions to the initial specification throughout the design process.
- Self-criticism and positive improvements suggested
- Listening to the views of others, particularly the client and modifying the design to make it more appropriate.

## **Unit 2 Part A: Designing, communicating, testing and presenting the design solution to a chosen controlled assessment task.**

Students must be given the opportunity to:

- Analyse client design briefs;
- Develop design specifications, generate ideas and select the most appropriate solution;
- Apply scientific principles;
- Produce and read engineering drawings;
- Select appropriate drawing techniques;
- Communicate a design solution to a mixed audience.

The design activity must be based around one of the controlled assessment tasks from the AQA website. It is important that candidates consider more than aesthetic properties. The solutions should include the use of some scientific principles and, possibly, calculations. It should also be considered that the students are expected to present their chosen designs using a range of suitable techniques.

### **When designing**

#### **Analysis of the design brief (5 marks)**

Candidates need to carry out an analysis of a given design brief to identify the key features, including: size, shape, function, limiting features, functional requirements... The key features should then be developed into a design specification. Students were generally able to list the client's needs and the key features of the product. However many students did not achieve the degree of analysis, required to meet mark band 3. In many cases well-written lists of the main features were presented or a diagram was presented that showed some of the key features together with a lot of irrelevant ones. Most students undertook some research into existing products which proved useful.

The better candidates were able to independently identify most of the key features for a given design brief and then go on to explain the key features in detail with reference to the client's requirements for the product and to justify their importance within the design brief.

#### **Generation and evaluation of design ideas (9 marks)**

Candidates should make use of the key features they have identified in creating a number of possible design ideas. These should then be developed into possible design solutions with consideration of the initial client design brief and the final design solution.

The majority of students produced imaginative design solutions and most to some extent considered engineering features in their solutions. Most students concentrated on aesthetic qualities at the initial design stages with some failing to consider engineering details or simple scientific principles when developing their solution. Remember this is Engineering not Resistant Materials or Product Design.

Mark Band 3 candidates should independently produce a range of possible design ideas from a design specification. The design ideas must then be developed into suitable detailed design solution. The candidates must be able to carry out structured tests to evaluate the suitability of the design solutions with reference to the customer requirements in order to produce a final design solution. It is not necessary to model the entire product; it is often sufficient to prototype a moving part, circuit or structure. In those centres that produced a model, they were used well to assess the suitability and modify the final solution.

### **When communicating (12 marks)**

Candidates will need to explain their chosen design solution in sufficient detail that it may be produced. This will require a range of engineering drawings and diagrams to be produced so that every aspect of the design solution is explained in sufficient detail. Drawings and diagrams must be appropriate for both the information being portrayed and the audience and they should be to recognised standards.

Most candidates were able to sketch, although the level of annotation was variable. A variety of 3D drawing methods was chosen including isometric and oblique and good use was made of 3D drawing packages and an increasing number of centres presented drawings using Google sketch up. Most candidates produced orthographic drawings with some being completed to sector specific standards. Some candidates had included assembly or exploded diagrams. It is not necessary to produce drawings using all the methods listed in the subject specification but mark band 3 candidates will be expected to demonstrate competence of a wide variety. The better candidates should be able to independently produce a range of sector specific drawings and diagrams that explain the design solution in detail. Drawings should be annotated where appropriate and comply with all relevant drawing standards and conventions. It should be possible to make a prototype product from the drawings.

Candidates must be able to produce engineering drawings that are sufficient to communicate their final design solution by selecting and using the following techniques appropriately: Sketching, manual formal drawing methods, orthographic, isometric, CAD (2D and simple 3D), 3D solid modeling. Students should also have used scale.

In this section teachers should make an assessment of how clearly, logically and organized the folder has been presented. Is the text legible, easily understood and does the work show a good grasp of grammar, punctuation and spelling. Of 12 marks in this section, a maximum of 3 are awarded for this.

### **When testing and evaluating (6 marks)**

Selecting and testing the final design idea against the design brief and specification

Throughout the design folder candidates should include evidence that they have tested, modified, and developed their ideas to produce the final design. Candidates will need to have carried out a formal selection of the final design idea and show evidence that they have tested their proposed solutions against the requirements of the client design brief and design specification. Again at this stage it is vital that candidates have written a full and detailed specification against which tests can be made. Basic scientific principles should be applied to the proposed solution to ensure that it will be able to perform the tasks as described in the customer design brief. This could take the form of calculations of force when using levers, the testing of different value electronic components or materials testing investigating hardness or strength.

Although testing can be evidenced throughout the portfolio it would be useful if candidates included a separate testing section in their folders. This would not only make moderation easier but would focus the students on the need to carry out specific tests.

### **Presentation of the final design idea (5 marks)**

Candidates should produce a final conclusion for their design project. This should include a final detailed explanation of their preferred design solution and explain why the other design solutions have not been adopted. They should present their work to a third party.

Modifications should be made in response to feedback and detailed within the folder. Several centres had encouraged the candidates to ask a number of open questions of the client. The

students then noted the response and showed details of suitable modifications in the form of notes and drawings. This approach would have been rewarded with mark band 3 marks. However this feedback need not necessarily be provided just at the end of the activity. It is possible for students to refer to the client/s throughout the design process.

## **Part B: Engineered Product**

**Centres are reminded that photographic evidence of the final product/products must be included with the student's portfolio.**

In this section students were engaged in making an engineered product. Some centres had clearly given the choice of project much thought and in all cases the choice of product had a major impact on success in this unit. In all cases the product must be based on one of the controlled tasks described on the AQA website. Centres can interpret the task based on equipment and materials available and generate a series of drawings to be given to the students. If teachers need more guidance with this they should contact their coursework adviser.

Both drawings and the product specification can be given to the students by the teacher.

For the benefit of the moderators it would be most useful if the product drawings and specification could be included at the front of the folder, or one set of drawings included with the pupil's portfolios. As described earlier, these drawings could be provided by the centre, or when a student has decided to make what they have designed, the folder will naturally flow from part A into part B.

Centres should remember that during Part B candidates should:

- Use product specifications;
- Read and interpret engineering drawings and diagrams;
- Show that they can select suitable materials, parts and components for a product;
- Create a production plan;
- Safely use processes, tools and equipment, including Computer Aided Manufacture (CAM), required to make an engineered product;
- Check that the quality of their work conforms to the standards required;
- Apply health and safety procedures.

### **Produce a production plan (5 marks)**

Candidates should analyse the specification, and show that they can make informed decisions regarding the manufacture of the product and to produce a production plan. They should study the specification and engineering drawings, listing the exact requirements of the product, including details regarding size, shape, materials, parts, components, processing methods etc.

Candidates must go on to produce a production plan **for the main parts of the product** planning the materials, resources and process requirements to make it.

As stated in the specification the plan should give information about:

- Materials, parts and components to be used;
- Processes to be used;
- Tools, equipment and machinery to be used;
- The sequence of production, including critical production and quality control points;
- Production scheduling, including realistic deadlines;
- How quality will be checked and inspected;
- Health and safety factors.

The most successful plans contained all this information within a pro forma sheet that the candidates completed either by hand or using ICT. In some centres, a separate production plan was completed for each component part. This seemed to be a sensible approach that allowed the candidates to break the making down into manageable parts. Some plans included a space for modifications or alterations that occurred during manufacture and a space for candidates to write about alternative production methods. (both mark band three requirements)

A comprehensive production plan is at the heart of a well-planned and produced engineered product and time spent at this early stage will be well rewarded.

### **Following a production plan (5 marks)**

It is useful at this stage that candidates have made on-going notes on their production plan of problems encountered and how they were overcome. This shows that the plan is an interactive document that has been referred to throughout the making process. Moderators will refer to the teacher's annotation and expect to see comments about the amount of help individuals asked for. The teacher's comments could be backed up by photographic evidence.

Mark band three candidates will have followed virtually all aspects of their plan, which will have itemized a sound selection of materials, resources and equipment.

### **Selecting materials, parts and components (5 marks)**

Candidates should provide evidence about how they selected materials. This could either be as a section within the production plan or some candidates submitted separate sheets about material selection. Moderators referred to teacher comments about the candidate's ability to use the materials. For example annotation would indicate that a student can identify a specific material from a range of materials and choose the most suitable cross section to minimize waste.

### **Selecting processes, tools and equipment (18 marks)**

Candidates should provide evidence about how they selected appropriate processes, tools and equipment. For some candidates this appeared in their production plan where the students had included an additional section entitled "Reasons for Choice of materials and production methods".

The mark band three candidates had suggested a number of production methods, suggesting why the one chosen was considered the most appropriate. The evidence was in the form of a written justification with complementary evidence in the quality of the product itself. Centres are reminded that photographic evidence must be included with the portfolio.

Teachers are asked to comment on the ability of individual candidates to select processes, tools and equipment. The annotated candidate record sheet should state:

- What the student did
- The degree of skill and accuracy demonstrated
- How they worked safely
- What safety equipment was used
- The degree of independence and confidence demonstrated

Mark band three candidates should independently select and use appropriate processes, tools and equipment, to safely and competently make a product, which exhibits a high level of skill and accuracy.



### **Testing the product in relation to the specification (5 marks)**

It is expected that candidates will have undertaken a number of objective tests comparing the final product to the specification. This appeared more successful in those centres where the students made the product they had designed. The students should be encouraged to use the product (for instance a clamp) and comment on how well it works.

Mark band three candidates will have used and provided evidence of a variety of relevant tests against all of the specification points. Quality control checks will have been made at all critical points during manufacture and have been used to ensure compliance to all aspects of the specification. The product will comply with the specification and will be of a high quality.

### **Part C When applying new technologies**

Marks for this final section are to be drawn from parts A and B of the students' folder. It is therefore assumed that while designing students will have considered and investigated the impact of new technologies and been given the opportunity to carry out CNC operations.

### **Investigate engineered products and describe new technologies (6 marks)**

Several centres included additional pages in the folders to show how products had been investigated. This seemed at odds with the fact that the evidence should be a part of the students' designing. While designing a can crusher, for instance, a number of products could be disassembled and the manufacturing processes and materials described. All up to date products will include elements of new technology in both their manufacture and the materials used. It would therefore make sense for candidates to investigate engineered products at the analysis stage of their designing. Products could also be investigated when alternative materials and manufacturing methods are being suggested in part B.

### **Describe and carried out several CNC operations (9 marks)**

Centres should give their students a number of opportunities to describe and use CNC operations while working through parts A and B of the project. This could be using a simple CNC card cutter to make a model or a laser cutter to produce component parts for the made product.

Several centres have asked if they could submit evidence not associated with the students' designing (part A) or making (part B). This is not acceptable.

For candidates to be awarded the maximum marks they should be able to describe and demonstrate the use of at least two different CNC machines.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available at [www.aqa.org.uk/over/stat.html](http://www.aqa.org.uk/over/stat.html)

The UMS conversion calculator can be found at [www.aqa.org.uk/umsconversion](http://www.aqa.org.uk/umsconversion) .