

Moderators' Report/  
Principal Moderator Feedback

Summer 2016

Pearson Edexcel GCSE in  
Manufacturing (5EG01)  
Paper 1: Engineering Design and  
Graphical Communication

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Summer 2016

Publications Code 5EG01\_01\_1606\_ER

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## Unit 5EG01

### Engineering Design and Graphical Communication Introduction

This was the sixth year of assessment for the specification. Centres submitted evidence of learners being required to design a wide range of products for manufacture.

This report makes reference to the key support documentation for 5EG01, which consist of;

- The unit specification for 2EG02
- The Teacher Support Book for Controlled Assessment for 2EG02 (see website)
- The Controlled Assessment Task for criterion e) for 5EG01 (see website)

The starting point for this unit is the design brief provided to learners. The format and content of the design brief is determined by the centre. Guidance is available to centres in the 2EG02 Specification, the Teacher Support Book and via website exemplars about the expected features of the design brief. Centres should appreciate that the quality and content of this design brief and associated specification will be a major factor in determining learners' ability to access the full range of marks across all criterion. When structuring the design brief centre staff might consider working from the end of the assessment criteria towards the beginning. That way they could consider "if my learners need to show they can do this for this criterion I need to give them this information in the design brief".

The design brief should balance the complexity of the task with the capabilities of the learners. Should the task require too complex a solution some learners will be unlikely to succeed. If the task can be solved simplistically then learners are unlikely to be able to demonstrate the full range of skills required to access the higher marking ranges.

The 5EG01 assessment criteria require learners to develop design ideas that relate to the function of a product, and not just the products physical appearance. Where learners tended to focus on aesthetics more than function the higher marks ranges were not be accessible.

The Controlled Assessment Task for criterion (e) requires the interpretation of a specific Pearson set mechanical/electronic engineering drawings. Learners will respond to a standard set questions related to identification and explanation. This task is reviewed every two years and the 2014-2016 version was the appropriate version for use during this series. Centres reading this report must ensure that they use the correct valid version for future cohorts. This will be available from the Pearson website.

Quality of Written Communications (QWC) is assessed in 5 out of the 8 criteria but was rarely referred to specifically by centre staff. Assessment of QWC considers students' abilities to:

1. Write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear.
2. Select and use a form and style of writing appropriate to purpose and complex subject matter.

3. Organise relevant information clearly and coherently, using specialist vocabulary when appropriate.

Those criteria where QWC is assessed are indicated by the use of \* after the criterion title.

### Administration

The teacher guidance for the controlled assessment task includes the following paragraph that centres should take note of;

#### Awarding marks

*It is essential that you identify where you have recognised candidate achievement. Therefore you will need to complete the following Controlled Assessment Tracking Sheet for each candidate, with annotation explaining the marks given against each criterion, and attach it to the candidate's portfolio.*

The Controlled Assessment Tracking Sheet (CATS) is an essential source of information for the moderator, as it directs them as to where to find the relevant evidence. Without this being accurately completed the moderator could miss relevant evidence that the centre has given learners credit for. This lack of clarity could result in the moderator not agreeing the marks awarded by the assessor.

The example below, from this year's entries, illustrates how an effective CATS directs the reader to the appropriate sources of evidence. This is in contrast to those received with not annotation or page numbering.

Assessment Evidence	Annotation and Page Numbering	Centre mark
(a) Analysing the brief	Design brief 2 / client's needs 4 / Analysis of brief 3	3 /6
(b) Details of the design criteria and production constraints	Design specifications 5-6 / Analysis of brief 3	4 /6
(c) Ideas and design solutions	Initial ideas 7-8 / Developed designs 9-14	5 /6
(d) Testing and selecting the final solution	Testing against client's needs 17-21 / Made prototypes to test and develop final design solution 17-21	6 /6
(e) Interpreting engineering drawings and circuit diagrams	CA03 24 / CA04 25 / interpreting CA02 & CA04 26 Orthographic drawing with symbols 14	5 /6
(f) Selecting and using engineering drawing techniques	Initial designs 7-10 / CAD drawings 20 & 3D 11-13 Orthographic design 14	5 /6
(g) Producing engineering drawings	Use of a range of relevant symbols CAD drawings 11-13.	5 /8
(h) Presenting and modifying the final design solution	Final solution annotated 17-18 [client needs] Evaluation / Modifications 21-22 Feedback 23.	4 /6

Centres are also reminded of the importance of accurately calculating the total mark awarded to learners and the requirement to enter the same mark into the online or OPTEMS system. Where there are inaccuracies with the marks recorded for learners this may result in certification delays and additional administrations tasks.

## **Assessment Criteria**

Centres made good use of the expected evidence detailed in the teacher support book. Where there was a clear link between expected evidence, student work and teacher assessment students were able to access the full range of marks available. Where the expected evidence is absent from learners work it is unlikely they will achieve marks from the higher ranges.

### **Criterion (a) Analysing the brief\***

In order to access the higher marks available for this criterion learners need to use the provided design brief to accurately explain the client's needs and justify the key features of the brief.

Learners consideration of client needs should include reference to cost, quantity required, intended market, timescales and product function. Of these factors timescales were frequently the least well addressed by learners. Centres could consider including details such as how long the learner has to complete the entire unit, how long they have to manufacture the prototype or deadlines for completion. This would then allow learners to comment on these later in the project.

Centres should also carefully consider the quantity of products they require the learners to design for. Where learners were required to design for batch or volume production this frequently added unneeded complexity to the design brief. A one-off prototype would be an accessible and appropriate quantity for most of the design briefs submitted this year for moderation.

Learners descriptions of key features should consider product performance, styling and aesthetics, size and quality standards. Of these quality standards were frequently the least successfully addressed by learners. When centres decide on the product that is the focus of the client brief they should ensure that relevant standards for the product are accessible to learners.

### **Criterion (b) Details of the design criteria and production constraints\***

In order to access the higher marks available for this criterion learners firstly need to explain product criteria and how their design proposals will address product performance, intended markets, maintenance requirements and size in their design proposals. This clearly links to their analysis from criterion (a).

Having determined what the client requires from the product learners then need to consider those factors that will constrain their proposals. They should take into account product regulations, cost, scale of production required, materials, quality standards and limitations of available machinery. Of these, the limitations availability of machinery tended to be overlooked by the majority of learners. This is something that centres might easily address, for example by requiring learners to research the production resources available to them. For example, if learners were to consider the potential use of vacuum forming for a solution they could explain the maximum size would be 300mm \* 400mm as this is the size of the bed on the available vacuum forming machine. In a similar manner learners could restrict their choice of materials to those available at the centre.

### **Criterion (c) Ideas and design solutions\***

This criterion is closely linked to criterion (f) Selecting engineering drawing techniques. Learners should be encouraged to develop their design proposals such that they can demonstrate a wide range of drawing techniques. Again this links back to the initial design brief and specification provided by the centre. Where a successful design solution could be formulated by the learner without the need to include block,

flow, schematic or circuit diagrams access to the high marks ranges is unlikely in subsequent criteria.

Centres should be aware that there are limited benefits of learners considering a wide range of alternative proposals. Rather than superficially considering numerous design proposals two or three design ideas considered in depth are more likely to provide access to the higher mark ranges. For this examination series only a minority of learners considered scientific principles or calculations as part of their proposals. Where learners tended to focus on aesthetics, and ignore the engineering function of their proposals, access to the higher mark ranges was limited in this and subsequent criteria.

#### **Criterion (d) Testing and selecting the final solution\***

Those centres whose learners performed at the high marks ranges in this criterion tended to adopt similar approaches. Typically their approach consisted of the following.

- For two or three of the design proposals physical prototypes that modelled some aspect of their performance were produced. These included CAD models of electronic circuits, breadboard circuits, models assembled from construction kits such as Lego, wood and card models of mechanisms etc.
- These models were subjected to some form of objective testing. The tests were photographically recorded and annotated.
- Results from tests were recorded objectively, displaying quantifiable data.
- This data was then used to select a final design proposal.
- The learners used this data, combined with their own preferences, to present a detailed justification of the final selected design proposal.

This approach contrasted with those centres whose learners tended not to access the higher mark ranges. Their approach typically consisted of the following.

- Attributes of products that only existed as drawings were considered.
- Comments are offered without evidence to support them. These would typically include comments related to cost (without any calculations), ergonomics and aesthetic appeal.
- The results learners presented tended to give the answers they wanted, rather than being used to gather useful information. Typically the first idea presented by learners would be the one with the best "results".

Where some learners did conduct high quality objective testing there was a slight tendency for them to not use the results of this testing to justify the selection of the final solution.

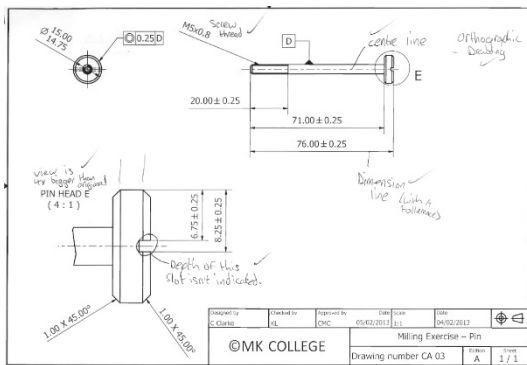
#### **Criterion (e) Interpreting engineering drawings and circuit diagrams**

For this criterion the specification provides guidance to how marks are allocated.

For Question 1, which comprises of 6 questions related to drawing CA03 and 5 related to drawing CA 04. 2 marks are available.

For question 2, 1 mark is available for the correct answer to each of the four questions, comprising of 2 related to drawing CA 03, and 2 related to drawing CA 04.

Centres should consider how they require learners to present their responses to the questions. The example below illustrates an approach that is both easy to follow and allows the learner to ensure they have answered all questions.



Question 2 CAO3

1  $\pm 0.25$  in relation to 76.00 means it can be 76.25 or 75.75 if its outside these quality dimensions it won't pass quality control.

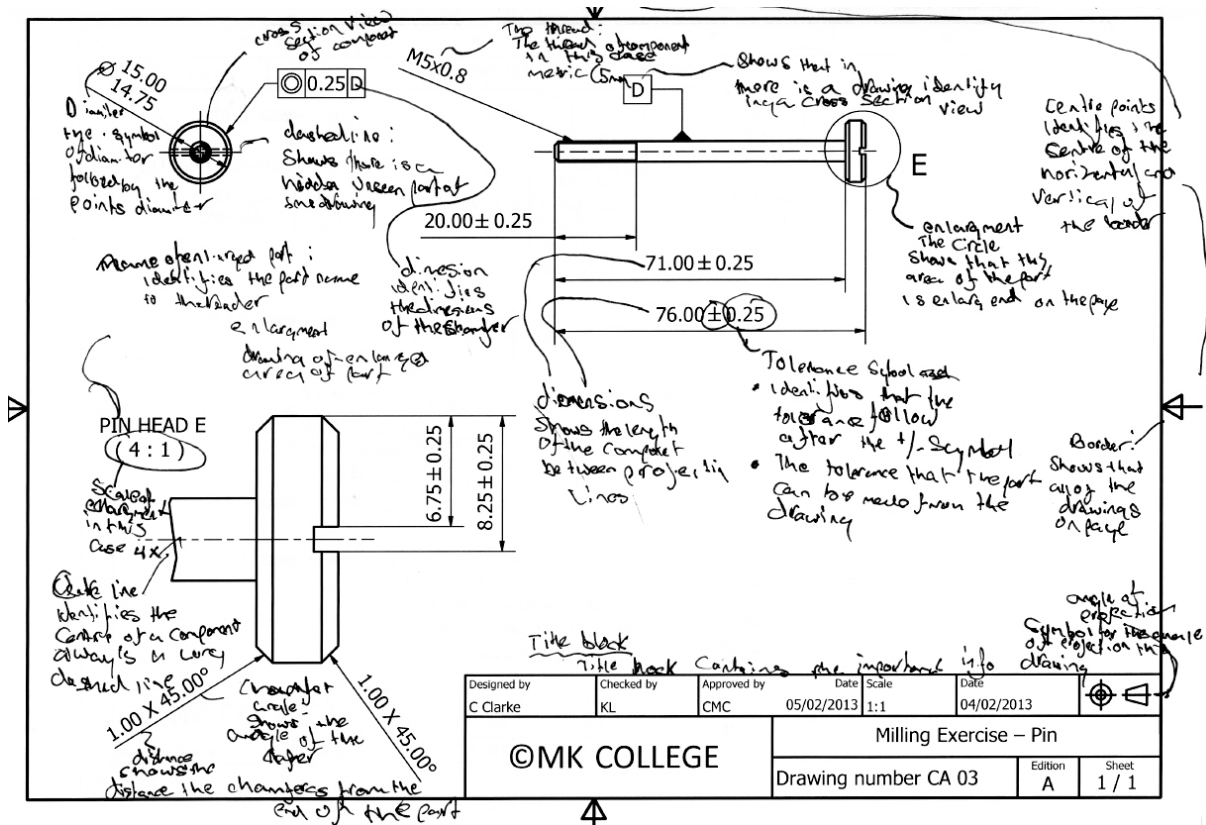
2 3rd angle projection is shown by this symbol

Question 2 CAO4

1 Component R resists the flow of current & protects the component behind it

2 Stores electricity and releases it slowly. It can also be used with resistors to produce a timer

This style of answer should be compared to the next example, where moderators may find it difficult to locate the correct information and the learner may not have answered all questions.




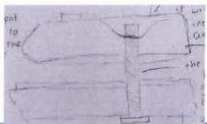




### Criterion (f) Selecting engineering drawing techniques

This criterion requires learners to provide two types of evidence. Firstly they need to consider the purpose and intended audience for a range of drawing techniques. In



order to access the high mark range learners need to consider freehand sketches, perspective drawings, block and flow diagrams, schematic diagrams, circuit diagrams, 1st/3rd angle orthographic projections, assembly diagrams and exploded diagrams.

A successful approach used by some centres was for learners to present this information in a table, of the type shown below.

SELECTING ENGINEERING DRAWING TECHNIQUES			
Name of drawing	Internet drawing	My drawing	Description of drawing
Assembly Diagram people that are designing items and they have to see the inside to see the parts on the inside so they gat them all correct			Assembly diagram is a method for visually representing three-dimensional objects in two dimensions in technical and engineering drawings
Isometric projection for people that maybe need to see how many sides a part or object needs to have.			Isometric projection is a method for visually representing three-dimensional objects in two dimensions in technical and engineering drawings
Free hand sketches. An artist or designer would use this type of drawing because they need them maybe for a car design they are bringing out in several years to come.			drawn or executed by hand without guiding instruments, measurements, or other aids=

Secondly learners need to demonstrate the use of a range of these techniques to communicate details of their final design solutions. As highlighted in previous sections if the design brief does not require learners to demonstrate this range of techniques potential access to the higher mark ranges will be limited.

### Criterion (g) Producing engineering drawings

For this criterion learners should produce drawings that include orthographic projection and circuit diagrams (electrical/electronic and/or pneumatic/hydraulic). Parts and components need to be included for higher mark ranges, which makes assembly drawings and exploded views appropriate for the highest score. These drawings should be produced both manually and through CAD. The evidence for this criterion will come from the drawings produced by the learner throughout the project. This criterion has a larger mark allocation of 8, compared to other criteria where the maximum mark is 6. These marks are awarded for the demonstration of drawing skills.

Learners were able to access the full range of marks available for this criterion. Where learners had access to appropriate CAD packages some very skilful drawings were evidenced.

### Criterion (h) Presenting and modifying the final design solution\*

The final criterion of the unit requires learners to compare their design proposals with the design brief to determine the extent to which the design meets the clients requirements. This comparison and the portfolio are then used to present their design proposals to a client, typically this was the teacher that assessed the unit.

The learner should then use the feedback from the client to identify and describe further modifications to improve their proposal. These descriptions of the modifications were often successfully evidenced by learners through the production of amended drawings.

