

Moderator's Report/
Principal Moderator Feedback

Summer 2017

Pearson Edexcel GCSE in
Manufacturing (5EG02)
Paper 2: Engineered Products

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General Comments

The performance of centres in this examination series was similar to that in the previous series.

Those centres whose candidates tended to achieve the higher mark ranges were characterised by:

- Selecting a product to be produced that had an appropriate degree of demand for their candidates.
- Providing their candidates with clear and detailed manufacturing specifications, and a set of drawings to allow the learners to produce the product. This will include tolerances for learners to work to.
- Allocating an appropriate amount of time for all of the assessment criteria to be addressed by their candidates.
- Supporting their candidates' achievements with detailed and comprehensive observation records and / or photographic records.

In previous examinations series, it has been the final bullet point made above that had the most influence over the results achieved by learners. This year the majority of centres appreciated the importance of providing appropriately detailed observation records and photographic evidence.

Witness testimonies, to support the ephemeral evidence of how much learner support is given or total independence, should be entered on the proformas provided on-line. It is valuable if every criterion has a witness testimony completed by the centre. Where centres awarded high marks for independence, this needed to be supported by appropriate learner evidence in their portfolio and specific personalised witness testimony in order for the moderator to agree centre awarded marks. Where one aspect of this evidence was absent, centres were often judged to be lenient in their assessment decisions. Examples of the different styles of witness testimony provided by centres are shown below.

This first example is a generic witness testimony that does not indicate to the moderator how the performance of the learner differed from others. The testimony covers three different criteria a, b and c. The final paragraph indicates that the learner lacked the confidence to work independently, but does not inform the moderator if significant or limited support was provided. While skill, safety and accuracy are recorded as being at a “medium” level these considerations are not mentioned in the assessment criteria and are therefore of limited use. Centres should appreciate the role of the witness testimony is to confirm the learners’ performance at the time of completing the work, not to offer expectations of future performance.

GCSE Engineering– Unit 2

Witness statement.

Assessment unit.

- a) How you used a product specification and engineering drawings
- b) Information about resources and processing requirements (production plan)
- c) Information about production details and constraints (production plan)

Process.

General planning, in the form of a production plan alongside evidence that he can respond to the need to change depending upon the availability of tools and materials
 Read drawings to recognise material requirements, used drawings to mark and check from.

Found some difficulty in this but I think there will be improvements as the course progresses.

is a methodical worker but at present lacks the **confidence** to work very independently.

Level of skill.	high		medium ✓	low	
Level of safety.	high		medium ✓	low	
Degree of accuracy	high		medium ✓	low	

This second example of a witness testimony is focused on the performance of the specific individual learner and links the observed attributes of the learner with the evidence presented in the portfolio. The comments offered link directly to the work from the teacher support booklet and clearly show the mark awarded for each criteria.

a) Read and interpret a product specification and engineering drawings 1 diagrams. was very confident in the use of both the specification and the engineering drawings. He used and referred to both throughout the project, very rarely needing any clarification. As a result of this evidence I feel that comfortably fits into the upper band of 'independent and confident use of the main information within a product specification and competent interpretation of the main details in engineering drawings and diagrams'. (6)

b) Produce a production plan which includes information about resources and processing requirements Through a detailed production plan identifies fully the main details of all resources and processing requirements. Evidence includes time planning in the form of a Gantt chart, analysis of the component parts, how materials are appropriate to those parts and possible material alternatives. Section B is very detailed, I therefore feel that his work fits into the upper band 'independently produce a production plan that identifies fully the main details of the resources and processing requirements'. (6) In terms of the quality of written communication, I feel the high levels of accuracy allow to be placed in the upper band, as noted in the criteria 'grammar, punctuation and spelling errors are unusual and there is good use of accurate terminology'.

c) Produce a production plan which includes information about production details and constraints Through a detailed production plan identifies fully the main details of production requirements and constraints. Evidence includes information on processes, tools and equipment, time management, and other production factors as a result of this evidence I feel that comfortably fits into the upper band of 'independently produce a production plan that identifies fully the main details of production requirements and constraints'. (6) In terms of the quality of written communication, I feel the high levels of accuracy allow to be placed in the upper band, as noted in the criteria 'grammar, punctuation and spelling errors are unusual and there is good use of accurate terminology'.

Learners are rewarded for the identification, preparation and use of materials, parts and components, including bought-in components, and selection and use of processes, tools and equipment, with safety and skill, and accuracy, at the upper mark range. Evidence must be provided by learners about this criterion

Centres are able to choose their own product to be made and tested and all of the work for the unit is produced under controlled conditions (33 hours max).

The quality of written communication (QWC) demonstrated by students is a progressively assessed component in three of the criteria: b), c) and h). The eight-mark criterion f) is for the safe and skilful use of processes and can be seen as the reward for the demonstration of safe and accurate practical skills.

A wide range of 'engineered product' projects continue to be used for this unit. In order to enable access to the full range of marks available the product should allow learners to demonstrate the processes of removal, shaping, joining, heat and chemical treatment and surface finishing, as listed in the unit specification.

The quality of written communication (QWC) demonstrated by students has less prominence in this unit, being directly assessed at only three criteria (the two planning criteria and the product evaluation one at the end).

Learners are provided with a full set of drawings and product specification. The drawings should include details of dimensions / tolerances etc. For each to enable learners to access the full range of marks for criterion (g) to produce an engineered product. The specification should also provide performance details for the complete system to allow learners to access the full range of marks available for criterion (h) Testing and evaluation.

The images below show a specification, for a can crusher provided to learners from the year's series.

<u>Component</u>	<u>Materials</u>	<u>Measurements</u>
Body	Aluminium U Section 4"x2"x1/4" wall, 250mm long	Use engineering part drawing no: U2-2009-PT-CC01 Body
Bottom	Plain Carbon Steel weldment, 3mm thick sections	Use engineering part drawing no: U2-2009-PT-CC02 Bottom
Slider	Aluminium	Use engineering part drawing no: U2-2009-PT-CC03 Slider
Lever Arm Body	Plain Carbon Steel strip, 25mm wide x3mm thick	Use engineering part drawing no: U2-2009-PT-CC04 Lever Arm Body
Lever Arm Tab	Plain Carbon Steel strip, 3mm thick	Use engineering part drawing no: U2-2009-PT-CC05 Lever Arm Tab
Lever Arm Spacer	Nylon Rod, 25mm Diameter	Use engineering part drawing no: U2-2009-PT-CC06 Lever Arm Spacer
Link Arm	Plain Carbon Steel Strip, 15mm wide x 3mm Thick	Use engineering part drawing no: U2-2009-PT-CC07 Link Arm
Link Arm Spacer	Nylon Rod 15mm Diameter	Use engineering part drawing no: U2-2009-PT-CC08 Link Arm Spacer
Handle Spindle	Alloy Steel Bar, 12mm Diameter	Use engineering part drawing no: U2-2009-PT-CC09 Handle Spindle
Handle Grip	Nylon Rod, 25mm Diameter Bar	Use engineering part drawing no: U2-2009-PT-CC10 Handle Grip
Drip Tray	Rigid PVC 1-2mm thick	Use engineering part drawing no: U2-2009-PT-CC11 Drip Tray
Slider Bush	Nylon Rod, 15mm Diameter	Use engineering part drawing no: U2-2009-PT-CC12 Slider Bush
Spring Washers	Sprung Steel, M6	Use engineering assembly drawing no: U2-2009-ASY-CC11Can Crusher Assembly
Plain Washers	High Tensile Steel, M6	Use engineering assembly drawing no: U2-2009-ASY-CC11Can Crusher Assembly
Cap Head Screws	Various Lengths and Heads, High Tensile Steel, M6	Use engineering assembly drawing no: U2-2009-ASY-CC11Can Crusher Assembly

<u>Finish Applied</u>		<u>Quality Indicators and Critical Control Points</u>	
Body	None	Body	Dimensionally accurate, free from burrs and sharp edges, slider bushes unobstructed in slot
Bottom	Powder Coat	Bottom	Dimensionally accurate; free from burrs and sharp edges, welds are secure, fits correctly with body, unblemished finish
Slider	None	Slider	Dimensionally accurate, free from burrs and sharp edges, moves freely within body with slider bushes
Lever Arm	Painted	Lever Arm	Dimensionally accurate, free from burrs and sharp edges, weld is neat and unobtrusive, unblemished finish
Lever Arm Body	Painted	Lever Arm Spacer	Dimensionally accurate, free from burrs and sharp edges
Lever Arm Tab	Powder Coat	Link Arm	Dimensionally accurate, free from burrs and sharp edges, unblemished finish
Lever Arm Spacer	None	Link Arm Spacer	Dimensionally accurate, free from burrs and sharp edges
Link Arm	Powder Coat	Handle Spindle	Dimensionally accurate, free from burrs and sharp edges, Free rotation of handle
Link Arm Spacer	None	Handle Grip	Dimensionally accurate, free from burrs and sharp edges, Unblemished finish
Handle Spindle	Oil Black	Drip Tray	Dimensionally accurate, free from burrs and sharp edges, slide in and out of bottom easily
Handle	None	Slider Bush	Dimensionally accurate, free from burrs and sharp edges, slides freely in body slots
Drip Tray	None—Self finishing plastic	Assembly	Lever mechanism operates smoothly without undue effort being required, no excessive play in joints, crushes can without damage to crusher
Slider Bush	Lightly Grease		
Spring Washers	Plated (as supplied)		No sharp edges, device is securely mounted before use, safety goggles are worn during testing, assembly checked by teacher before use
Plain Washers	Plated (as supplied)		
Cap Head Screws	Plated (as supplied)		

The accompanying drawings clearly detail the dimensions of all the components. This specification allowed learners to access the full range of marks available for criterion (g) Produce an engineered product. However, the specification does not provide details of how the complete assembly should perform and therefore learners was unable to gain the full marks available for criterion (h) Testing and evaluation. This illustrates the importance of centres providing learners with specifications that allow access to all aspects of the assessment scheme for the unit.

Assessment Criteria

(a) Read and interpret a product specification and engineering drawings/diagrams

In order for learners to access the marks available from the higher range of marks, the evidence contained in the learner's portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate, witness testimony was not provided moderators tended to determined that the centre's assessment was lenient.

Centres used a variety of approaches to generate evidence for this criterion. These included;

- Learners producing assembly drawings from individual component drawings
- Learners annotating drawings of components to highlight key dimensions.
- Learners annotating drawings of components to consider manufacturing requirements.

- Learners were set questions on the spec. and drawing to respond to.
- Learners annotating schematic diagrams to explain the function of components.
- Learners extracting and recording details of the “measureable” aspects of the products performance.

Those learners that used a combination of approaches tended to access higher marks than those who used a single style.

The image below illustrates how one learner annotated a drawing to demonstrate their ability to interpret an engineering drawing.

Part 1

An M5 hole will be drilled here on MS in smaller than M6.
 M6 needs to be tapped
 D10
 80 +/- 0.2
 This means that it can be within 79.8 and 80.2mm. The tolerance is +/- 0.2mm.
 Title: Support
 Material: Mild Steel
 No: 4 Off
 This is used for the bar.
 4 of these bars will need to be made.
 Note: Painted Finish
 This means that we need to use a primer to get a smooth even finish.
 overall tolerance
 Tol: +/- 0.5mm Unless stated

Part 2

Under cut
 R6
 D12
 8
 12
 26
 M6
 An M6 die is used so that a new thread is made so it can screw onto the bar.
 Title: Pad
 Material: Brass
 No: 4 Off
 This is the material the feet will be made of. This is good as brass does not rust.
 4 feet will be needed to complete the product.

GCSE Engineering	Drawn By	
	Title	Dice Project
	Material	As stated
	Date	13th March 15

(b) Produce a production plan which includes information about resources and processing requirements

In order for learners to access the marks available from the high range, the evidence contained in the learner’s portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate witness testimony was not provided, moderators determined that the centre’s assessment was lenient.

For this criterion learners need to provide evidence in the form of a production plan that details resources and processing requirements. In order to access the high mark range, learners needed to consider materials, parts, components, tools and equipment and any assembly techniques required. Learners also need to include

information related to the measuring equipment to be used for criteria (g) and (h). Learners also needed to provide evidence of processing requirements such as details of processes to be used.

(c) Produce a production plan which includes information about production details and constraints

In order for learners to access the marks available from the high range, the evidence contained in the learner's portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate witness testimony was not provided moderators determined that the centre's assessment was lenient.

For this criterion learners need to provide evidence in the form of a production plan that details machine settings and speeds, tooling details, sequence of production, health and safety requirements for the process. The most frequent omission from learners' evidence related to machine settings and speeds. This is an area centres should ensure is addressed in future series if learners are to access the full range of marks available.

Learners also need to consider production constraints including quality control points, deadlines, machine availability, inspection procedures, cost of materials and machine time. Very few learners provided evidence of considering machine availability and machine time. Centres should consider how they can support learners to help them generate appropriate evidence for the factors. For example, learners might be required to complete a document to request access to specified equipment at particular times. This system might also help generate appropriate evidence for deadlines as other learners may have requested access to the same equipment at a later date/time.

Many centres join criteria b and c together to form a joint production plan, and this often means that important data is missed out. It would be helpful to moderators if two production plans could be used, one for resourcing and processing requirements, and the other for production details and constraints (see assessment criteria).

(d) Identify, prepare and use materials

In order for learners to access the marks available from the high range, the evidence contained in the learner's portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate witness testimony was not provided moderators frequently determined that the centre's assessment was lenient.

Centres used a variety of approaches to generate evidence for the first part of this criterion, the identification and preparation of materials. These included;

- Notes produced by learners allowing them to identify appropriate materials.

- Annotated photographs of learners selecting the materials required from a stock of materials that contained alternatives.
- Comments contained with the production plan detailing the preparation of the materials.
- Annotated photographs of learners preparing the materials.

The second part of the criterion requires learners to submit evidence of their safe use of materials with skill and accuracy. Evidence related to safety was recorded appropriately by the majority of centres with evidence being provided in the production plan and annotated photographs of the users working safely.

Evidence of learners demonstrating skill and accuracy tended to not be so clearly evidenced by centres. Centres tended to present photographs of complete products, rather than detailed images of the components that make up the whole product. Centres are advised that it would help the moderator agree centre allocated marks if photographs were provided that clearly show the high quality of the manufactured components. It is likely that a high quality product will have been produced as a result of the learner, demonstrating skill and accuracy. Evidence from criterion (g) will also be used to support the marks awarded for this criterion.

The image below exemplifies the use of annotated photographs to support the marks awarded for the criterion.

What am I doing?

Measuring out the aluminium ready to be marked

Why am I doing this?

So that when I cut out the aluminium it will be the right size, if it is too small then the front will not fit into it and I will have to start again.



How does this impact on skill and accuracy?

Using a steel rule is precise so the base will be the right size.

Health and safety?

My hair is tied up so that it doesn't get caught in machinery, this is also the reason I have removed my tie. I am wearing an apron to protect my clothing and I am using common sense and not being reckless which could result in an accident and injury.



(e) Identify, prepare and use parts and components

In order for learners to access the marks available from the high range, the evidence contained in the learner's portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate witness testimony was not provided moderators frequently determined that the centre's assessment was lenient.

This criterion requires learners to work with "bought-in" components.

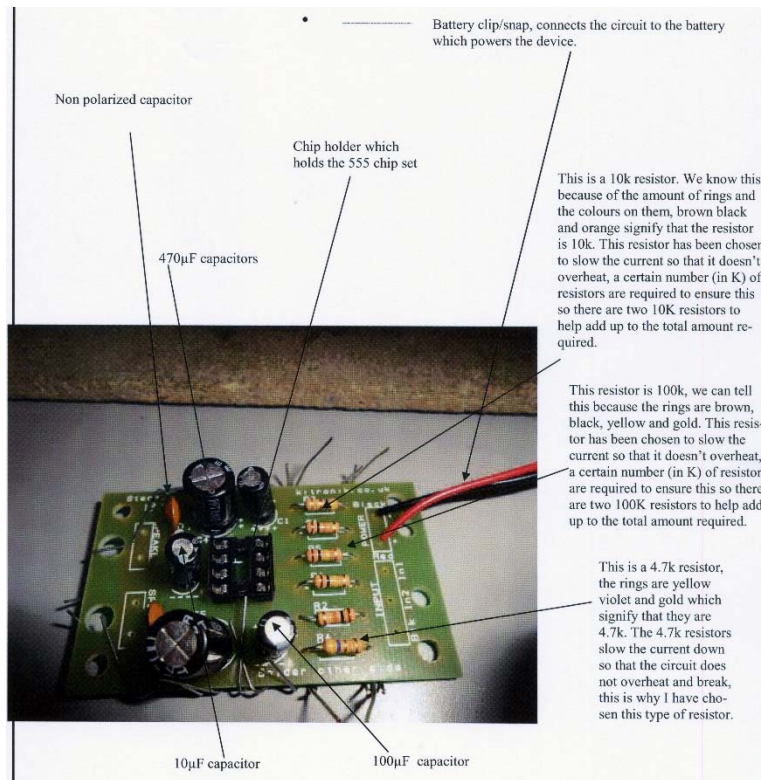
Centres used a variety of approaches to generate evidence for the first part of this criterion, the identification and preparation of appropriate parts and components.

These included;

- Notes produced by learners allowing them to identify components, such as identifying the appropriate colour bands of the resistors being used.
- Annotated photographs of learners selecting parts and components from stock.
- Comments contained with the production plan detailing the preparation of parts and components.
- Annotated photographs of learners preparing to use parts and components. This often took the format of the components of an assembly being laid out before being joined together.

The comments made for the use of materials above also apply to this criterion for the use of parts and components.

The image below exemplifies the use of annotated photographs to support the marks awarded for the criterion.

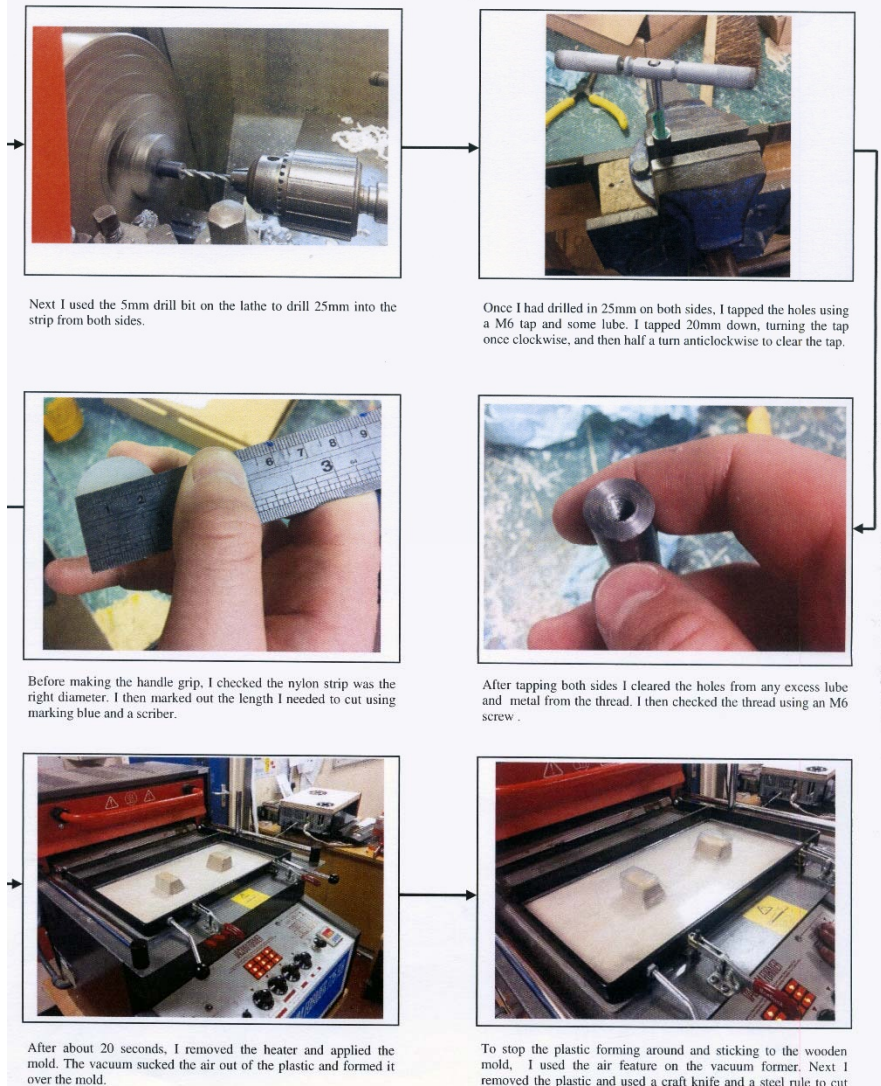


(f) Select and use processes, tools and equipment

In order for learners to access the marks available from the high range, the evidence contained in the learner's portfolio must be supported by witness testimony that confirmed the learner operated independently. Where appropriate witness testimony was not provided moderators frequently determined that the centre's assessment was lenient.

For this criterion most centres provided a range of good quality photographs that clearly recorded learners using a wide range of processes, tools and equipment. As the criteria (d) and (e) are also related to the skilful use of tools and equipment evidence presented by learners frequently was credited across several criteria. This in turn meant that the marks awarded across all three criteria were typically in the same mark ranges (high, middle or low).

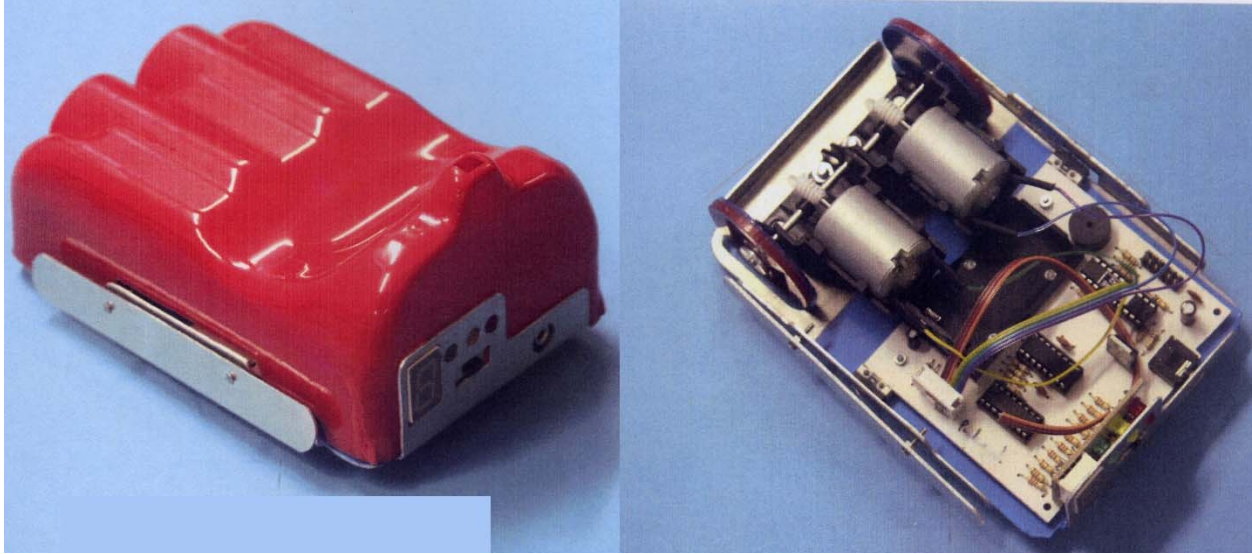
The image below exemplifies the use of annotated photographs to support the marks awarded for the criterion.



(g) Produce an engineered product

Marks are awarded in this criterion for the quality and accuracy of the components that make up the complete finished product and assemblies. Witness testimony should be combined with a photograph/s that are sufficiently detailed to allow the moderator to make judgements on the characteristics of the components that make up the complete product and to see clearly the finished product. These attributes tended to be accurately assessed by the majority of centres.

A photograph of the completed product is a very useful method to centres to support the marks they award for the accurate manufacture of the product. The example below illustrates the type of image most useful for moderators. The pictures focus on the product and are sufficiently clear and detailed to allow confidence in the marks, related to accuracy and quality, to be understood by the moderator.



The second element of the criterion requires learners to complete inspection sheets that record physical dimensions, or outputs of subsystems. This element was not successfully addressed by a number of centres, and some wrongly used inspection sheets suitable for Criterion g (see below).

Where centres awarded marks from the middle and higher mark ranges, the following situations were observed that resulted in the moderator determining that centre assessment was lenient.

- Inspection sheets that compare the product to a toleranced dimension and simply record pass/fail.
- Inspection sheets that record dimensions without providing the moderator with an indication of what feature the measurement relate to.
- Learners recording dimensions to high degrees of accuracy without providing evidence of the ability to measure to that accuracy, e.g. recording a measurement of 10.1mm using a steel rule.

It would help moderators to agree to centre awarded marks if witness testimonies referred to the validity and accuracy of learners completed inspection sheets.

The image below illustrates several aspects of good practice for this criterion. The method used to measure the components provides an appropriate degree of accuracy. The learner has described the methods used. Actual measurements of the components are recorded; these offer greater validity than a simple pass / fail statement.

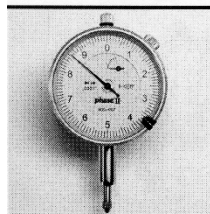
Part 1 Support x 4 off

Nominal Size	80mm
Limits (Low)	79.8
Limits (High)	80.2
Tolerance	0.4
Deviation	+/- 0.2
Mean size	80.00

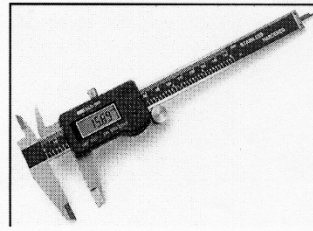
Description of inspection techniques used:

Firstly we made sure that all of the mild steel bars were in the tolerance of +/- 0.2 by using a digital calliper and a dial indicator. We used the digital calliper and dial indicator because they are more accurate than using a steel rule as they give answers to 2 decimal places. On a steel rule there is gaps between millimetres therefore you will be guessing measurements if it is between the millimetre marks therefore you will not be accurate. It is important to be accurate because we are given a tolerance of +/- 0.2 so that the die actually fits correctly when you come to assembling the product as the bars are in the correct tolerance for the die to be assembled correctly.

Component	Measurement
Bar 1	80.05 ✓
Bar 2	79.92 ✓
Bar 3	79.91 ✓
Bar 4	80.12 ✓



Dial Indicator



Digital Calliper

(h) Testing and evaluation

This criterion requires that the completed functioning product is tested against the specified product performance, rather than the detailed production control measurements that are rewarded in (g). In order to access the full range of marks available for this criterion, the design brief and associated specification provides learners with measurable success criteria for the completed product. It is useful if a number of questions are used, e.g. Does the product do what was intended, followed by an objective test which measures whether it does or not.

Once learners have acquired the data from tests, they need to present them clearly. Typically, those centres whose learners accessed the high marks available for this criterion presented their data graphically, and with quality notes. This forms the 'evaluation' by learners' to complete their task.

Conclusion

Learners, and centre assessors, are again congratulated in 2017 for the work they carried out towards the completion and testing of their engineered products. There was the typical range of success, rewarded appropriately after moderation, and student photo-narratives showed application, attention to safety and again some pride. Portfolios again gave an impression of the enjoyment of a worthwhile engineering experience and it can be hoped that this will be built on in progression

opportunities, which are also likely to require a blend of practical and communication skills measured against criteria.

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