EXAMINERS' REPORTS

LEVEL 1 / LEVEL 2 AWARD IN ENGINEERING (TECHNICAL AWARD)

SUMMER 2023

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ENGINEERING (TECHNICAL AWARD)

Level 1 / Level 2 Award

Summer 2023

UNIT 1 – 9356 – MANUFACTURING ENGINEERING PRODUCTS

General Comments

This was the first series for Unit 1. This series saw a range of evidence submitted from all centres which included some excellent levels of planning, production and evaluation being undertaken. Many of the submissions clearly benefitted from the experience of delivering the legacy qualification in previous years. Candidate evidence was in the main well-presented and there was clear diversity in the methods that candidates chose to present their individual work.

There are areas that need further development; Health and safety considerations and risk assessments tended to be superficial in many instances which lacked the level of detail required to access the higher marks.

Candidate evaluations are also an area which requires focus to ensure that candidates are able to cover the range of requirements in the task. Many were superficial and did not review the given criteria to the required depth or suggest viable improvements linked to the candidates' working methods and quality of outcome.

Overall, for the majority of centres, this was a good start to the new specification, especially those centres that had not previously undertaken the legacy qualification. The details below summarise the areas of good practice and areas for improvement for the next submission of unit 1.

Comments on individual questions/sections

Task 1(a) – (10 Marks) AO1 and AO3

AO1 (4 Marks) Many candidates addressed this well by ensuring that key components were clearly identified, giving clear descriptions of their purpose. This was often undertaken by good annotation marked on the technical drawings. Some candidates also produced additional sketches to explain function or manufacturing details. Candidates who did not use this method found it more difficult to ensure they clearly addressed the task objective.

AO3 (6 Marks) This section was well addressed by many candidates who used the key information provided to clearly identify areas such as tapping drill sizes, features such as chamfers, blind holes, and machine speeds. This was undertaken in several ways by candidates, some clearly added the information again to the provided technical drawings, some created tables or included the information further into their evidence where candidates displayed planning information in Task 2(b). All of these methods were valid and allowed access to the full range of marks.

Task 1(b) - (4 Marks) AO1
AO1 was addressed well in this task as candidates used a variety of methods to present the details from Task 1(b) including tables, lists, annotations on the technical drawings and notes on sketches using additional sheets. Where candidates had included information further into their evidence, it was still considered as an outcome that fully addressed the 1(b) Task. There were clear advantages to using a structured method as it appeared that learners who undertook this task primarily as handwritten sheets would often omit some key information due to the nature of them focusing on one part or component at a time. This will be a key area of focus in the next CPD events.

Task 2(a) - (10 Marks) AO2
This task was addressed in several different methods by candidates, all of which allowed access to the full range of marks for AO2. A common method was to produce a job sheet which detailed stock material sizes, often supported by finished component sizes and many candidates included references to tolerances (Task 1(b) AO3). Many candidates detailed this task using tables offering a range of alternative materials before identifying suitable ones for the manufacturing process. Again, some candidates used the supplied technical drawings to identify, with notes, suitable materials for component parts, some included additional notes on the equipment needed to produce them. There were numerous amounts of evidence of candidates splitting this task up into multiple parts, some focusing on cutting lists to identify materials, job lists for stock sizes and then using the planning stage (Task 2(B) AO2) to identify tools and equipment. All methods are acceptable and a focus on assessment strategies will be included in future CPD events to ensure centres are familiar with the diverse ways in which candidates are able to present their work for assessment. Centres who have assessed the legacy specification will be more familiar with this varied method of addressing tasks in a range of sections from within the specification.

Task 2(b) (10 Marks) AO2
This task was performed in a variety of ways by candidates, allowing the mark scheme's requirements to be met in a variety of ways. There was a good range of GANTT charts used by candidates, which reflected the way in which centres had been using them in the latter part of the legacy specification. There was little evidence of excessive use of GANTT charts attempting to cover many assessment criteria in one go. This was again encouraging to see. There were also successful submissions for this task where candidates had produced detailed written submissions to clearly explain steps of production. A small number of submissions were completed retrospectively, which limited marks due to the task being based on 'planning' and not 'review'.

Contingency plans were better considered than in the legacy specification and these appeared in various areas throughout the candidates' evidence. The range of contingencies covered was also broad however mostly all were viable in nature and offered realistic mitigations to overcome potential problems.

The presentation of this task varied based on how the candidates decided to detail the production process. Sometimes the information had to be unpicked from the text to find the details needed to produce a part or component, meaning it was not an efficient way to access the information with regards to effective use in a workshop environment. Overall, planning stages compared well to that of the legacy specification with the aforementioned contingency details being a key improvement overall.

Task 2(c) (6 Marks) AO3
Responses to this task were weaker than the legacy specification with many candidates giving basic responses which in some cases did not provide much detail about equipment and processes such as, the application of engineers' blue to stock metal. This was found to be insufficient to allow access to the higher marks for this task.

Candidates should consider firstly the equipment (lathes, mills, drills etc.) and then identify the potential risks with appropriate control measures. Areas such as sawing, filing etc. can be completed under a general, combined risk assessment section for hand tools. This will allow access to higher marks. There were limited instances of candidates mentioning guards on equipment during this series compared to previous series with the legacy specification. This needs to be reinstated.

Task 3 (16 Marks) AO2
In general, this task was undertaken well by most candidates. There were many high-level outcomes seen, which demonstrated the production of every component part on the engineering drawings to a high-level of tolerance and finish. There was a good range of materials being used by candidates as the tasks required the selection of appropriate materials to produce the given engineered product.

Many candidates took the opportunity to present a work diary to respond to elements of this task. These often included a combination of photographic evidence of components being produced, the implementation of risk mitigation (Task 2(c) AO3), use of individual tools and checks on finished tolerances (links to task 4B).

Most centres submitted detailed observation records which helped the moderation process by identifying the candidates' ability to work independently and safely during the production process and, by supporting the rationale for the marks allocated. This should be encouraged to be implemented by all centres as part of a normal submission.

Task 4(a) (12 Marks) AO2
This task was undertaken well by most candidates and there was a good range of skills evident in the submission for the unit. These ranged from clear understanding and implementation of machining processes, through to competent and effective use of hand tools to accurately measure, cut and shape stock materials into completed components.

A small number of centres relied heavily on 3D printing to produce components, and this limits access to the higher mark range due to an absence of a range of processes. Using 3D printing to produce duplicate tasks i.e., lock nuts are perfectly acceptable provided that one of the lock nuts has been produced according to the technical drawings as this provides access to a greater range of skills and processes.

A small number of centres omitted duplicate parts from the production stages. This did not affect marking however this should be avoided as the unit's overall purpose is to accurately produce an engineered product in line with the technical drawings. As mentioned above, substituting duplicate parts with bought in components or 3D printed components still meets the requirement of the unit.

Omitting parts may limit a candidate's understanding for the unit 2 task which is now linked to the outcome of the unit 1 task. This task also focuses on the use of a range of materials. Centres should avoid where possible to limit the available materials to one type. Centres should also avoid using soft woods or timber as this is not typically considered as a material for engineering and can have an adverse impact on the accuracy of components produced. Overall, this was addressed well with the majority of centres offering several alternative materials for candidates to select from.

Task 4(b) (12 Marks) AO3
This task focused on the candidate's ability to evaluate the quality of the finished engineered product and the processes used. It should be supported by candidate recommendations of how to improve the unit's overall outcome.

This section was not implemented as well as the prior tasks with candidates often simply writing a dialogue of what they had done. Many of these had limited evaluative comments and made little reference to the accuracy, the quality of finish or tolerances of completed components.

In many instances, there were no references back to the criteria and many of the suggested improvements were superficial i.e., 'making sure I work harder next time'.

To access the higher marks, candidates need to ensure they review the criteria, tolerances, and their own working methods to a considerable level of detail. This should include a comparison between the sizes given and what the candidate achieved, any changes that may be implemented to the planning stages or alternative ways to process material to improve accuracy and quality.

Summary of key points

The first submission of this qualification was undertaken successfully by the majority of centres. Whilst this report does indicate areas where centres may need to focus on for the next series, it is worth reiterating from the general comments that for many centres this is the first submission of an engineering qualification with WJEC. These centres did not have the experience of the legacy specification to build from. Many of these centres have made an excellent start to their assessment at their individual centres.

With regards to areas of improvement for the next series, it is recommended that centres:

- Ensure their candidates are familiar with how to interpret engineering details and information from a given drawing. This is only achieved by practicing prior to undertaking unit 1. Ensure there is familiarity with the technical details i.e., feeds, speeds, tapping drill sizes etc.

- Ensure that planning stages are not completed retrospectively and that they are completed with time in mind. Ensure that processes are sequenced logically with enough detail to explain the steps involved in producing the parts or components.

- Risk assessments should include details on the key tasks focusing on equipment use, identify a severity of risk, and offer suitable controls to then mitigate those risks identified. Ensure that hand tools used for cutting etc. are classified under groups i.e., hand tools.

- Ensure a suitable range of materials are available to candidates to decide which to use to produce their outcomes.

- Evaluations must refer to the criteria such as tolerances or any other details supplied in the brief. There should also be a more focused explanation on how accurate the outcomes were along with the candidate's application of processes to meet the brief. Finally, candidates need to ensure they offer relevant improvements in areas such as finishes, processing and accuracy, as well as improvements to planning.

ENGINEERING (TECHNICAL AWARD)

Level 1 / Level 2 Award

Summer 2023

UNIT 2 – 9357 – DESIGNING ENGINEERING PRODUCTS

General Comments

This series saw a small number of submissions for unit 2. Therefore it is difficult to identify an accurate picture of how centres are undertaking the unit. That said, there is one key area that was overlooked by most centres in this series. This will be a focus point during future CPD events to ensure centres are clear on the requirements for assessment of this unit. The point in question relates to the overall design outcome from the given brief. Whilst candidates addressed most areas of the task well, the obvious key missing details were how does the new designed outcome physically relate to the linked task from unit 1.

To elaborate, many candidates generated suitable solutions for fixing a vice to a tabletop or desk as per the requirements of the brief. However, only a small number of candidates showed how their solution would attach to the existing vice from the unit 1 task. Without this detailed information, drawing or model, accessing the full range of marks for some sections is limited. For example, if the method of connecting the vice is not shown on the technical drawings, the product will be incomplete. Candidates should be issued with the unit 1 technical drawings to allow them to fully address the unit 2 brief that links to the unit 1 brief.

Comments on individual questions/sections

Task 1(a)(i) (2 Marks) AO1

The response to this task was mixed with such a small sample, however most candidates were able to identify the key functions of the product. Many used the information from unit 1 to identify key areas such as the upright support of the vice (where it would need to have the solution to unit 2 attached too). Several candidates also identified parts of the vice which may need to be considered to allow access to locking nuts etc.

Task 1(a)(ii) (2 Marks) AO2

In most submissions, candidates successfully identified suitable existing products which had similar functional properties to enable them to explore suitable design solutions. These were mostly done pictorially with descriptions which often related to marks awarded in Task 1(b). In a small number of submissions, there were excessive examples of these products, centres are advised to review the mark scheme as this task specifies two to three examples.

Task 1(b) (5 Marks) AO3

As mentioned, this task was often incorporated with the evidence for Task 1(a)(ii). Candidates were able to justify their decisions for selecting the engineered products. In many instances, the details included suitability of purpose, examples of the product in use and details on materials and components. Justifications were given as to why each were selected.

Task 2(a) (4 Marks) AO2
Candidates produced a range of designs but as mentioned most fell short of explaining how their solutions would attach or interact with the existing vice. There was also a general lack of detail as to how the mechanisms for the solutions would be operated. Many candidates simply relied on the pictures provided from earlier tasks. There needs to be clarity in both how the Unit 1 product and Unit 2 design solution interact / connects and how the design solution operates. This was rarely seen in these submissions.

Task 2(b) (4 Marks) AO3
Evaluating the solutions against the set criteria was done well using a variety of methods such as point scores, ACCESSFM and other suitable methods. It is important that candidates include a justification or rationale for their selected solution giving reasons based on how it meets the set criteria.

Task 2(c) (4 Marks) AO2
There was a good range of techniques used by candidates and some strong modelling using card and foam was seen to assist in the design process. Sketches in general were basic and some lacked sufficient annotation to explain features of the outcome in detail. There was limited CAD (Computer Aided Design) use evident however, this was a small sample and therefore difficult to judge. Using these models with the product from unit 1 would help access the higher marks for this task.

Task 3(a) (6 Marks) AO2
This task saw the variety of candidates producing the outcomes using conventional drawing techniques. There was minimal evidence of CAD in this small submission. To access the higher marks candidates need to ensure that they produce drawings following typical drawing conventions and ensure that they include an isometric view. Dimensions should be present for all design details and a title block featuring relevant drawing information should also be included. CAD is not a requirement for this task and hand drawn technical drawings are still able to access the full range of marks providing that they meet the criteria.

Task 3(b) 3 Marks) AO1
Responses to this task varied with many candidates not addressing the specification in sufficient detail. Candidates should revisit the Unit 1 brief to help them generate a specification for their design solution. Many of the submissions confused this with the 4(b) task and gave details on how to produce the outcome. For this task, candidates only need to focus on details such as: 'The locking pin must be simple to install with one hand' or 'the jaws of the clamp must not damage the surface it is attached too'. It may focus on finishing details, material properties or other technical details.

Task 4(a) (4 Marks) AO2
The application of mathematical techniques again saw a varied range of responses with some candidates producing good evidence to access the full marks. Their evidence was relevant to the problem, sufficient in complexity and well executed. Candidates can decide on which area to apply this task, many worked out area and cost, but it is important to ensure that sufficient depth and challenge is present. This task also gives good access to candidates who may not be strong mathematicians however still can gain marks with simpler responses.

Task 4(b) (6 Marks) AO3
It was positive to see that several candidates connected Task 2(b) in unit 1 and the requirements of this task in Unit 2. The need to be able to advise a third party on manufacturing their design solution is what is required for this task and candidates have experience of this already. It is up to the candidate if they decide to use a similar method to unit 1 or produce a separate way of presenting that information.

To access the higher marks, considerations need to be given to materials, including their properties, and the intended processes for production. Candidates need to justify their decisions with evidence. This could be a simple material test for a part of their solution. This may be drawn from earlier tests undertaken during the design stage.

Summary of key points

As mentioned in the general comments for this unit, a small sample gives limited scope to identify where common practices are occurring. With that said, the following points should be considered before the next series.

- Ensure that the Unit 2 design solutions clearly relate to the Unit 1 Manufactured product. There should be references to the Unit 1 product in the sketches and technical drawings for this unit's submission.

- Task 3(a) requires sufficient practice and teaching to allow candidates to undertake this task under controlled conditions. Ensure they are familiar with standard drawing conventions and understand what is needed in a technical drawing.

- Ensure that candidates are familiar with generating their own specifications to address Task 3(b). The selected specification points need to be relevant and justified.

- Task 4(a) needs practice to allow candidates to be able to identify a range of areas where they can apply mathematical calculations to meet the mark scheme requirements. Again, this will come down to sufficient practice earlier in the delivery of the qualification.

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