L3 Lead Examiner Report 1906

June 2019

L3 Qualification in Engineering

Unit 3: Product Design and Manufacture
31708H

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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:
http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Unit 3: Product Design and Manufacture

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	8	16	28	40

Introduction

Unit 3 (Engineering Product Design and Manufacture) is a mandatory synoptic unit that requires learners to complete a set task to redesign an engineering product. There are five activities to complete for the whole task. This was the fifth live task for this unit and learners were required to redesign a clamping solution to hold a pneumatic cylinder in position.

The external assessment task is structured to address the assessment outcomes for the unit. The assessment outcomes are:
AO1: Demonstrate knowledge and understanding of engineering products and design
AO2: Apply knowledge and understanding of engineering methodologies, processes, features and procedures to iterative design
AO3: Analyse data and information and make connections between engineering concepts, processes, features, procedures, materials, standards and regulatory requirements
AO4: Evaluate engineering product design ideas, manufacturing processes and other design choices
AO5: Be able to develop and communicate reasoned design solutions with appropriate justification

There is a marking grid for each of the five activities that make up the whole task. The examiners allocate marks to the assessment evidence provided by the learners, for each of the five activities, using a holistic 'best-fit' approach. They compare the evidence for each activity to the corresponding marking grid and the bands/strands/descriptor bullet points within.

Please note that all the examples of learner assessment evidence provided in this report are extracts. As a result, they can only be representative of evidence that would be awarded a mark from a certain band. All the assessment evidence for a given activity (which is generally quite extensive) must be considered when awarding a mark for that activity.

Learners are required to submit the Part B task booklet for marking. Any extra pages of assessment evidence must be headed with the appropriate activity number and securely fastened into the correct place in the task booklet using a treasury tag. This should be avoided wherever possible, as the space available in the task booklet, for each activity, is more than sufficient. Learners should not submit any of their research notes, the Part A documentation or the Part B information booklet, as none of the aforesaid are considered when marking

Introduction to the Overall Performance of the Unit

Pleasingly, the majority of learners appeared to find the task accessible. The examiners were able to award a full spread of marks for each of the activities and across the task as a whole.

The written content provided by learners was again highly varied, but many attempted to structure their responses with sub-titles for certain activities (such as Activities 2, 4 and 5) and this should be encouraged.

Similarly, the sketches/drawings provided by learners varied in quality; however, most were legible, drawn in three dimensions and communicated the proposals/solution to a suitable standard. For example, isometric drawings with explosions and reasonable attempts at orthographic projections for Activity 4 were often evident, which is to be encouraged. In addition, most sketches were annotated with a commentary rather than labels, and again this is to be encouraged.

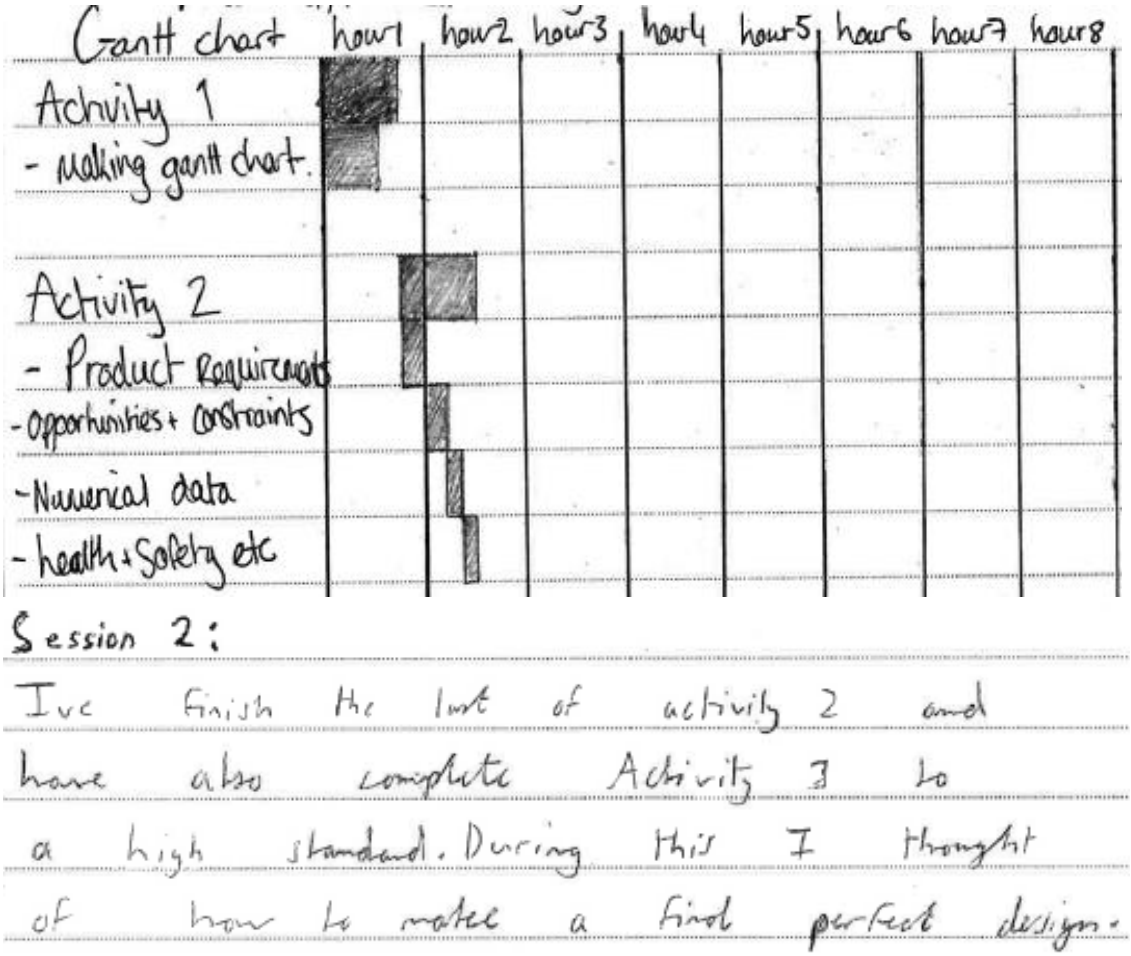
It was again not always obvious that learners had used their research, collected during Part A, in the most appropriate manner. For example, the Part A Set Task Brief advised learners to carry out research on existing designs of clamps. In general, there were some generic and/or specific comments about the features of existing clamps in the assessment evidence for Activity 4; however, actual sketches or diagrams showing how certain features (of existing clamps) had been incorporated into the learner's solution were again seen infrequently. In addition, it was again not clear that learners had researched sustainability at all stages of the product life cycle, as most responses simply focused on recycling. Nonetheless, it was again pleasing that many learners clearly did use their research when commenting on the suitability of materials and manufacturing processes in Activity 4.

In the most part, suitable responses were seen for Activities 2, 3, 4 and 5; however, many learners are still providing an unsuitable response for Activity 1. Learners' responses to all of the five activities that make up the whole task are considered in the next parts of this report.

Activity 1 - Planning and design changes made during the development process

This activity is designed to test the learner's ability to forward plan and to review/justify the changes made during Activities 2 to 5, in order to fulfill the requirements of the Part B Client brief. The assessment focus is to 'Carry out an iterative development process'. Many learners (including those of a higher ability) again seemed to interpret this activity as simply requiring a generic time plan and retrospective diary/reflective log, which mainly resulted in marks from Band 1.

For example:

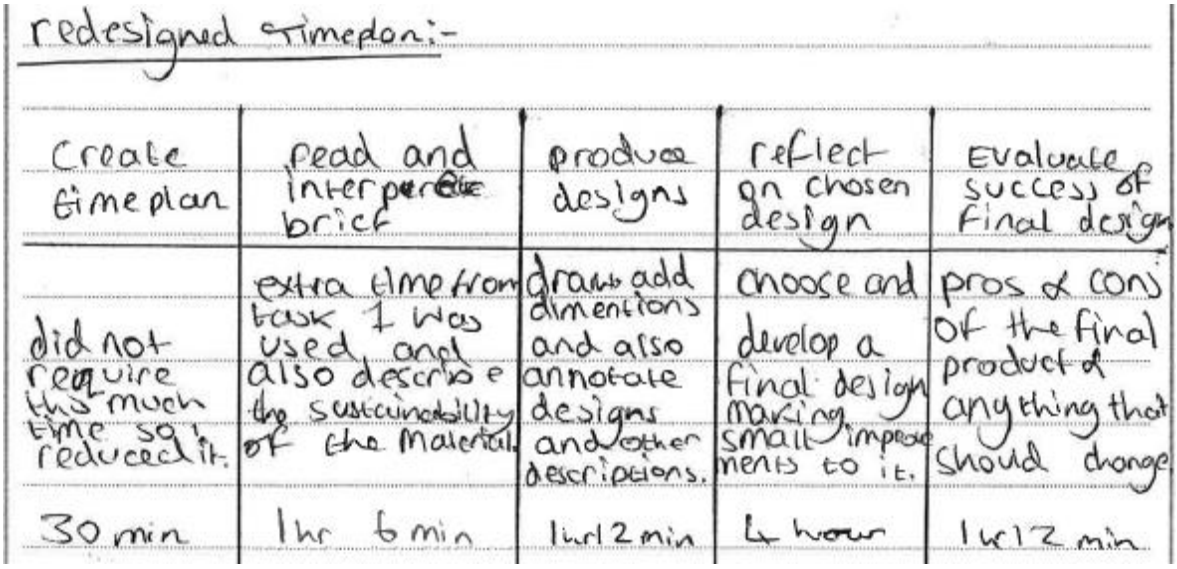


To gain higher marks, learners should (please refer to the Activity 1 marking grid):

- Provide a more detailed outline time plan that refers to the product being redesigned (in this case, a clamping solution to hold a pneumatic cylinder in position). In Extract 1, the plan includes more detail than the Gantt chart above but is still quite generic with no focus on the product to be redesigned and therefore it is still not representative of Band 3 evidence. Given that learners have a period to undertake research (for Part A) before they are provided with the Part B task, the initial plan should also refer to how the said research will be applied during Activities 2 to 5.

- Generate action points for the next session at the end of each session as part of Activity 1. The said action points should show forward planning that is clearly linked to the specifics of the product being redesigned, with some consideration of what happened in the previous session. Action points such as 'In the next session I will design four ideas' will not gain much credit. In Extract 2, the learner has generated a future action point for Activity 4 (in an upcoming session) that relates to a specific aspect of the Part B Client brief; however, this type of response is still not representative of Band 3 evidence, as there should be some indication of the particular modifications that will be applied to develop a 'viable solution'.
- Justify the changes made throughout the development process to fulfill the requirements of the Part B Client brief. In Extract 3, the learner has provided a suitable reason for the change made to an initial design idea during a session for Activity 4. This type of response is representative of Band 3 evidence.

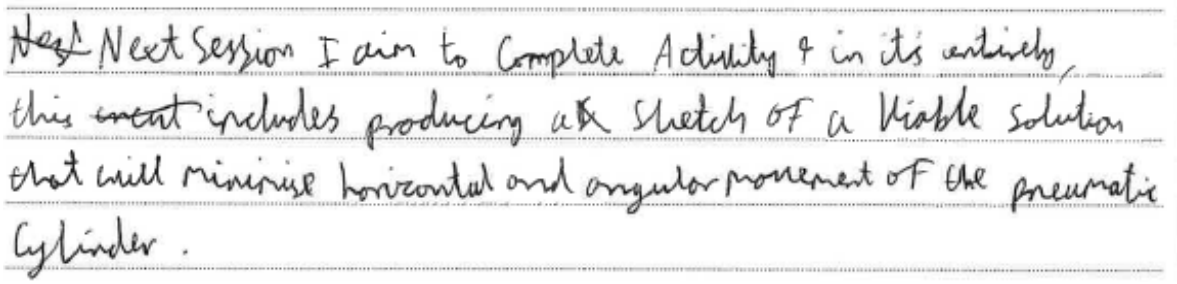
Extract 1 - An initial outline time plan



redesigned timeplan:-

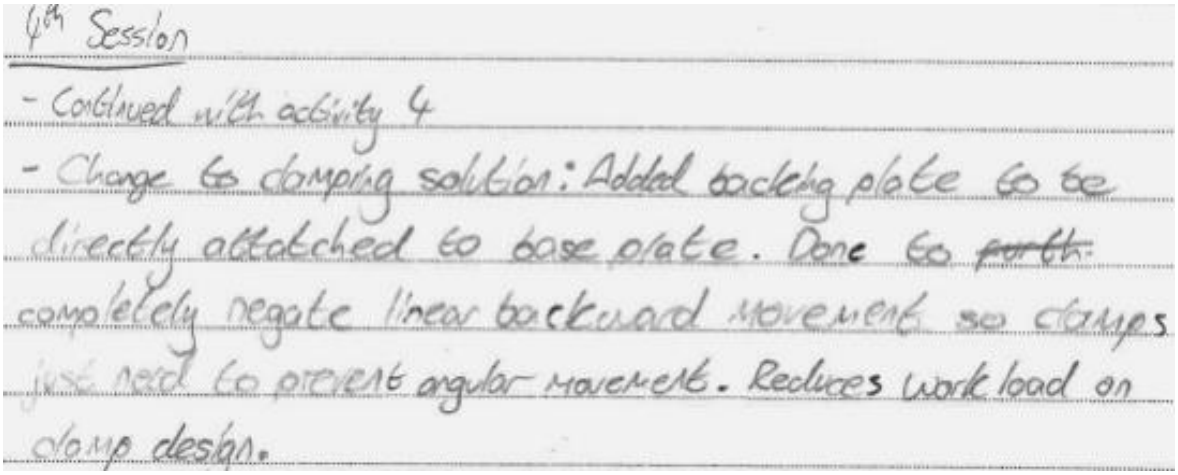
Create timeplan	read and interpret brief	produce designs	reflect on chosen design	Evaluate success of final design
did not require this much time so i reduced it.	extra time from task 1 was used, and also describe the sustainability of the material.	draw, add dimentions and also annotate designs and other descriptions.	choose and develop a final design making small improvements to it.	pros & cons of the final product & anything that should change.
30 min	1hr 6 min	1hr 12 min	1 hour	1hr 12 min

Extract 2 - An action point for an upcoming session



Next Session I aim to Complete Activity 4 in its entirety, this ~~event~~ includes producing a Sketch of a viable solution that will minimise horizontal and angular movement of the pneumatic cylinder.

Extract 3 - A change made during a session



The format of the assessment evidence provided for Activity 1 again varied greatly. The evidence required for Activity 1 should be provided in the following format:

- An initial outline time plan in a table that is specific to the product being redesigned (this must not be generic and should not simply reiterate the statements underneath each activity heading in the task booklet)
- Action points for the upcoming session/s that are specific to the product being redesigned (these must not be generic and should not simply reiterate the statements underneath each activity heading in the task booklet)
- Changes made during the session/s that are specific to the product being redesigned (not generic) and justified

The latter two bullet points can be repeated as many times as necessary. This type of format will allow learners to provide evidence that shows they have addressed each of the strands in the Activity 1 marking grid. As Activity 1 is worth 6 marks from 60 marks available overall, learners should provide an overall response that is succinct but pertinent.

Activity 2 - Interpret the brief into operational requirements

The command word used in this activity is 'interpret'. Learners are required to identify clearly the key features of the Part B Client brief, and to use the aforesaid and the other information available (including the numerical data and the drawings provided), to produce a set of suitable and cohesive operational and product requirements. In so doing, learners must also consider and make relevant comments on opportunities and constraints and key health and safety, regulatory and sustainability factors. The assessment focus is 'Interpreting brief into operational requirements.
The vast majority of learners attempted this activity and a wide range of responses were seen, resulting in a full range of marks across Bands 1 to 3.

In this series, the following characteristics were often evident in the response from learners that gained lower marks for this activity:

- The interpretation included a lot of simple repetition from the Part B Client brief.
- Actual calculations were not present, but some basic interpretation/conclusions resulted from a review of the data in Table 1.
- The consideration of health and safety factors was generic ('no sharp edges' etc.)/irrelevant (not specific to the context) and may have referred to, for example, HASAW 74, PPE, using safe machinery during manufacture etc.

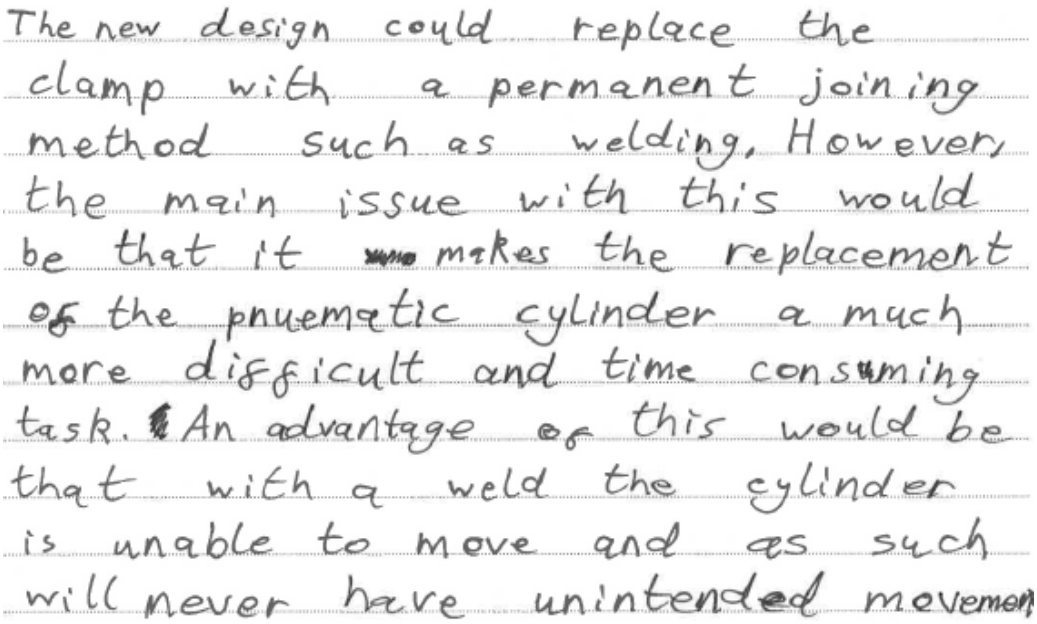
Conversely, the following characteristics were often evident in the response from learners that gained higher marks for this activity:

- The interpretation included numerous comments that extended the Part B Client brief, for example, 'It would be appropriate to have at least 4 fixing points so it is less likely that the pneumatic cylinder will twist and maybe a plate behind the cylinder so it is less likely it will move backwards.'
- Some straightforward calculations or graphs were present; in addition, suitable conclusions followed from them, for example, 'The angular and linear movement of the pneumatic cylinder increases over time and the velocity of the actuator exacerbates this.'
- Sustainability factors were normally considered; in addition, health and safety factors were commented on in context and usually extended the Part B Client brief, for example 'It would be good to have a method of releasing the clamps for changing or maintenance that doesn't involve a lot of rotation and is easy to do so hands are less likely to slip and get cut.'

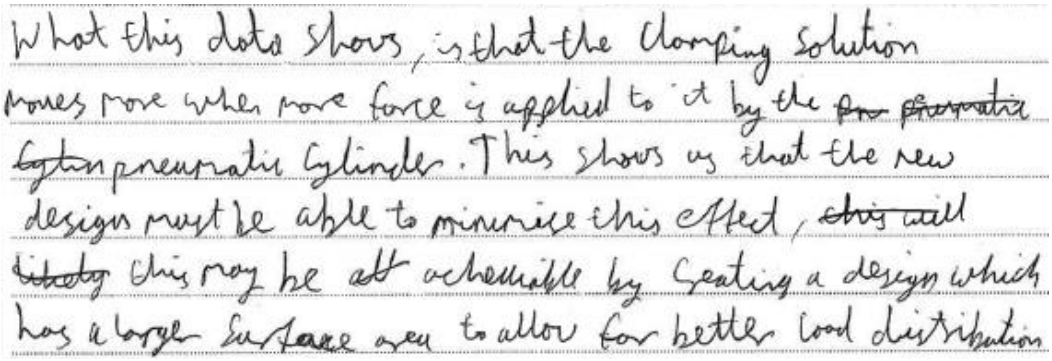
The following extracts show examples of some of the aforesaid characteristics (please refer to the Activity 2 marking grid):

- In Extract 1, the learner has interpreted the Part B Client brief and has considered the opportunities/constraints associated with a possible joining method in relation to four of the five bullet points at the bottom of the Part B Client brief (implicitly). Nonetheless, this type of response is still not representative of Band 3 evidence, as the permanent joining method is not a possible clamping solution.
- In Extract 2, the learner has used their calculations/graphs (not shown here - based on Table 1 in the Part B Client brief) to determine a possible product requirement that may allow the redesigned clamping solution to be more effective over time (enhanced product performance). This type of response is representative of Band 3 evidence.
- In Extract 3, the learner has made comments about health and safety that have some relevance to the product in hand; however, the said comments are mostly generic and would apply to virtually any replaceable part used in a system. This type of response is representative of Band 1 evidence.

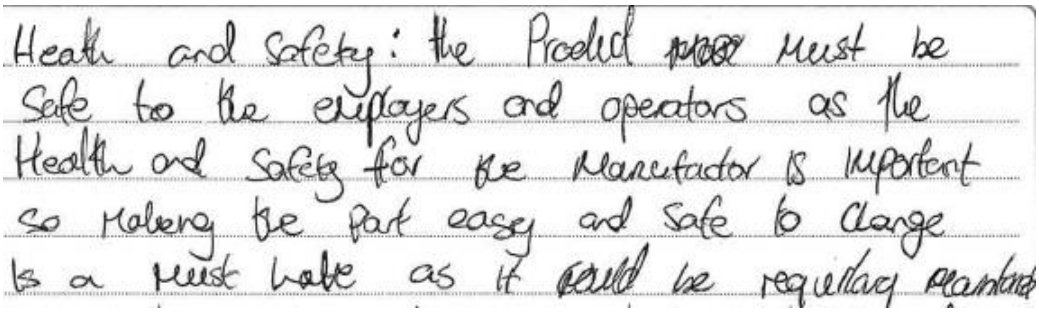
Extract 1


The new design could replace the clamp with a permanent joining method such as welding. However, the main issue with this would be that it makes the replacement of the pnuematic cylinder a much more difficult and time consuming task. An advantage of this would be that with a weld the cylinder is unable to move and as such will never have unintended movemen

Extract 2



Extract 3



The format of the assessment evidence provided for Activity 2 varied; nonetheless, the majority of learners that performed well on this activity:

- Extracted and then provided a list of all the issues and relevant operational requirements from the Part B Client brief
- Carried out some calculations/generated some graphs based on the numerical data and then provided some comments/conclusions to interpret the results and suggest some associated product requirements
- Generated a series of contextualised comments in bullet point form under a series of sub-titles that related to product requirements, opportunities/constraints, health and safety and regulatory/sustainability factors; in addition, the said comments were mostly justified in relation to the issues and operational requirements identified from the Part B Client brief

This type of format allowed learners to provide evidence that showed they had addressed each of the strands in the Activity 2 marking grid. As Activity 2 is also worth 6 marks from 60 marks available overall, learners should again provide an overall response that is succinct and pertinent.

Activity 3 - Produce a range of initial design ideas based on the client brief

Activity 3 requires learners to produce a range of (three or four) initial design ideas based on the Part B Client brief and their outcomes from Activity 2. The unit specification ('Key terms typically used in assessment') states that a design is 'a drawing and/or specification to communicate the form, function and/or operational workings of a product prior to it being made or maintained'. Activity 3 in the task booklet directs learners to use a combination of sketches and annotations; as a result, both must be present in order for learners to be able to achieve higher marks. The assessment focus is 'Initial design ideas'. Again, the vast majority of learners attempted this activity and a wide range of responses were seen, resulting in a full range of marks across Bands 1 to 3.

In this series, the following characteristics were often evident in the response from learners that gained lower marks for this activity:

- The initial design ideas looked very similar to the original clamping solution (a deliberately poor design) and/or each other, with just two or three small adaptations that were minor improvements and addressed just one or two of the five bullet points at the bottom of the Part B Client brief.
- The initial design ideas did not take into account that the existing base plate could only be modified and not totally redesigned, and/or did not include further/extended fixing points (rather than just two as in the original - a relatively straightforward improvement) and/or concentrated on amendments to the system rather than the clamping solution.
- The annotation was fairly limited (but technically accurate in the main) and covered the learner's thoughts about the positives and negatives of each design idea without much reference to the five bullet points at the bottom of the Part B Client brief, for example, cost may have been a focus.

Conversely, the following characteristics were often evident in the response from learners that gained higher marks for this activity:

- The initial design ideas were feasible/reasonably different to the original clamping solution and each other, when considering both form and approach; in addition, they included adaptations that were major improvements when compared to the original clamping solution and at least three/four of the five bullet points at the bottom of the Part B Client brief.

- The initial design ideas took into account that that the existing base plate could only be modified as stated in the Part B Client brief and included improved features related to, for example - a) improved robustness to retain the position of the pneumatic cylinder over time (to minimise angular/linear movement); b) easier fixing and removal of the pneumatic cylinder; c) increased contact surface area between the clamping solution and the pneumatic cylinder; and d) additional material use to improve the friction between the clamping solution and the pneumatic cylinder.
- The annotation was technically accurate and covered the learner's thoughts/rationale about each design idea with some reference to the five bullet points at the bottom of the Part B Client brief; however, generic/irrelevant comments about aspects such as aesthetics and extensive explanations related to manufacturing processes (which is a focus of Activity 4) were sometimes evident and gained no/less credit.

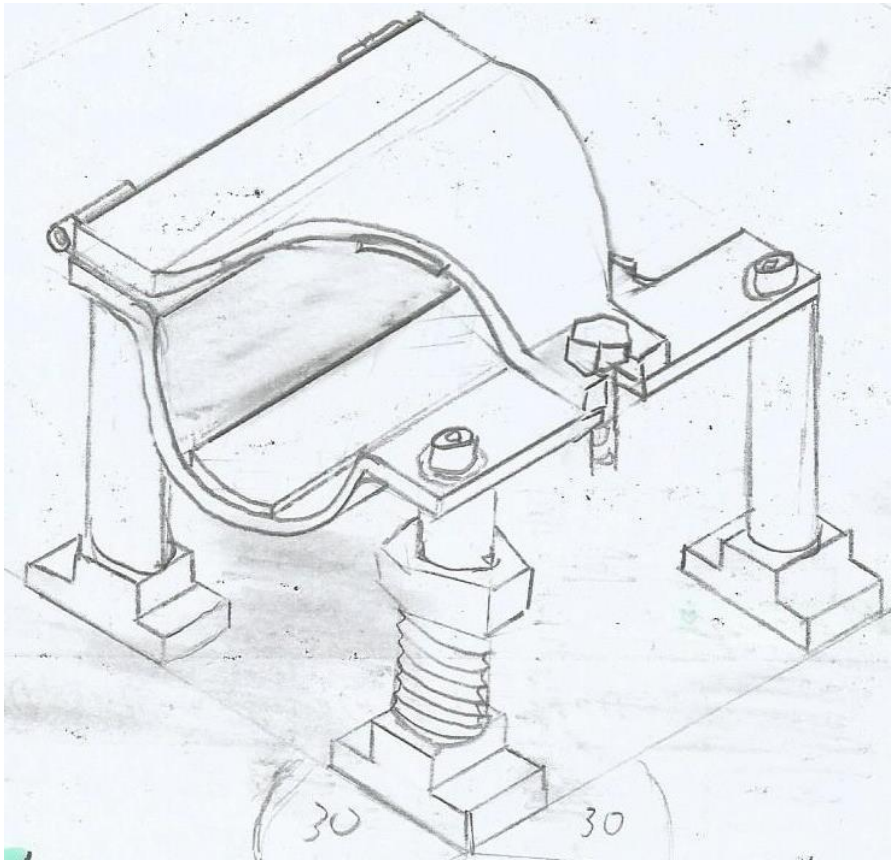
The following extracts show examples of some of the aforesaid characteristics (please refer to the Activity 3 marking grid):

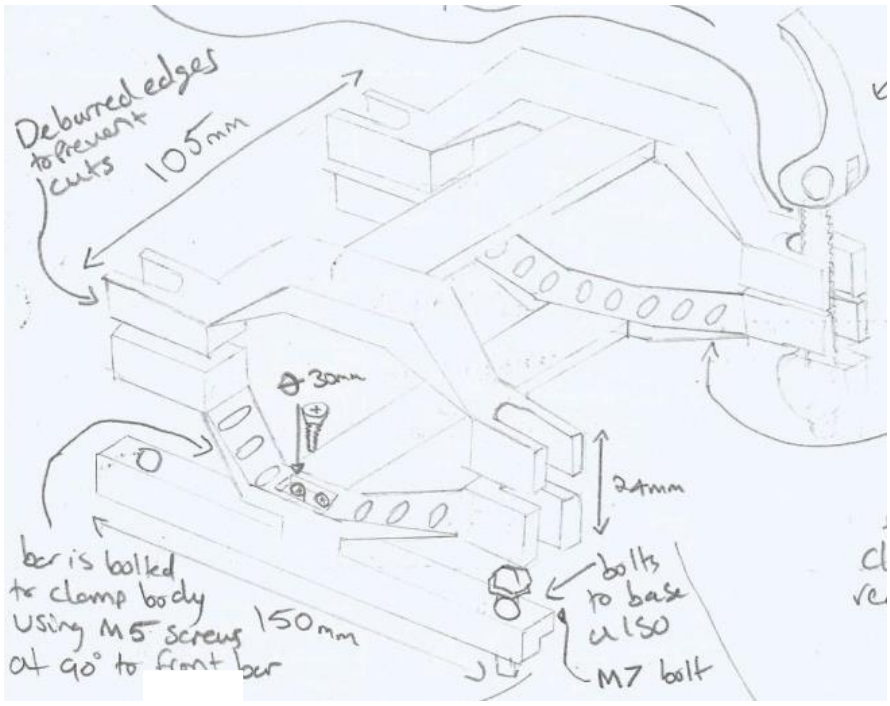
In Extracts 1a and 1b, the learners have generated ideas that comprehensively address the Part B Client brief and, although not perfect, they both include features that are major improvements when compared to the original clamping solution. In addition, they are both generally feasible and fit for purpose, and different to the original clamping solution, when considering both form and approach. These types of response are representative of Band 3 evidence.

In Extracts 2a and 2b, the learners have used written text/technical terms to communicate further detail and to explain a design idea with some reference to suitable product requirements that have been derived from the Part B Client brief. These types of response are representative of Band 3 evidence.

In Extract 3, the learner has generated an idea that includes a minor improvement (using a block rather than spacers; however, the depth of the block is not provided) when compared to the original clamping solution; nonetheless, the idea is still very similar to the original clamping solution and therefore this type of response is representative of Band 1 evidence.

Extracts 1a and 1b



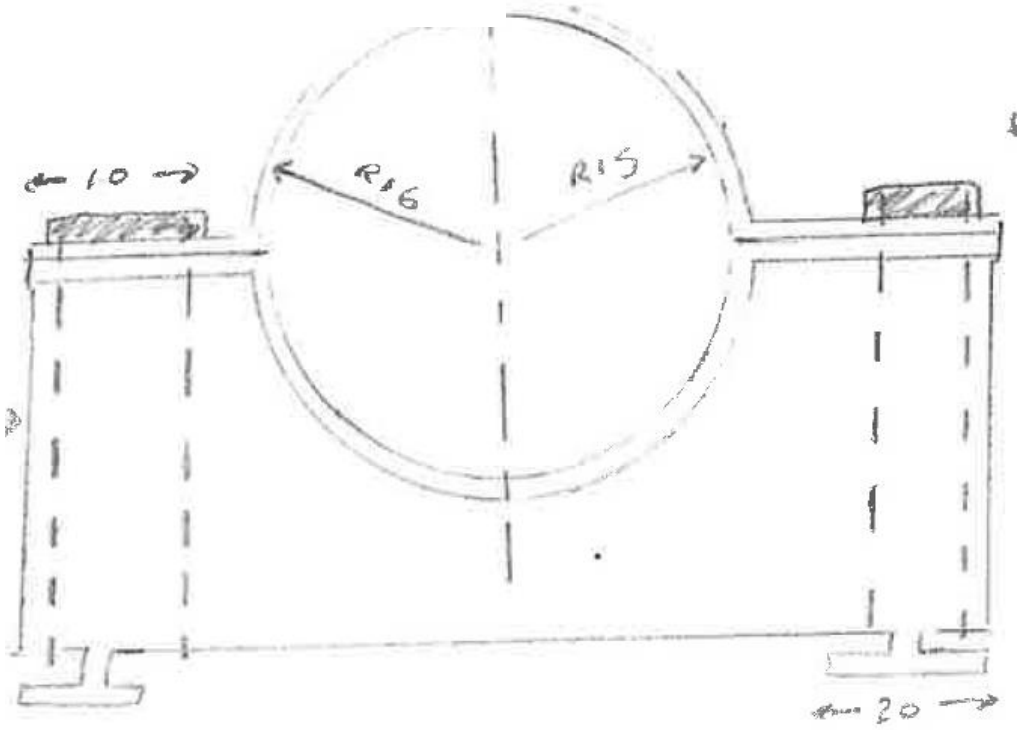


Extract 2a and 2b

With thicker material & a wide base force is distrubuted over a large area resulting in less movement & twisting. This should be able to remain in place.

- Will prevent twisting of cylinder with multiple clamps
- Will keep the cylinder in the right position as the ratchet gear won't allow the blade to move backwards
- Button to disconnect gears allows for quick removal of the cylinder

Extract 3



The format of the assessment evidence provided for Activity 3 was very similar in the most part, irrespective of the marks gained. Most learners provided:

- Sketches of ideas in isometric with some further drawn views, possibly as an explosion and/or as a side, front or plan elevation according to what the learner was trying to communicate
- Annotations (not labels) that explained the ideas, with those who gained higher marks providing comments that directly referenced the five bullet points at the bottom of the Part B Client brief

This type of format allowed learners to provide evidence that showed they had addressed each of the strands in the Activity 3 marking grid. As Activity 3 is worth 9 marks from 60 marks available overall, learners should provide an overall response that includes some detail.

Activity 4 - Develop a modified product proposal with relevant design documentation

Activity 4 requires learners to develop a modified product proposal based on the Part B Client brief and their outcomes from Activities 2 and 3. There is guidance as to what is required for a fully developed proposal in the task booklet [The proposal must include a solution including a final drawing and must consider existing products, materials, manufacturing processes, sustainability, safety and other relevant factors], and each of these should be addressed in the response in order to gain higher marks. The assessment focus is 'Develop a modified product proposal (form, materials and/or manufacturing processes)' and the subtask is 'Solution'.
Learners should include a range of relevant design documentation to support their proposal. The said documentation is exemplified in section C2 of the Unit 3 specification. As with Activity 3, learners should use appropriate sketching and graphical techniques, along with technically accurate written content, to articulate fully their modified product proposal. The assessment focus is 'Develop a modified product proposal (form, materials and/or manufacturing processes)' and the subtask is 'Design Documentation'.
Again, the vast majority of learners attempted this activity and a wide range of responses were seen, resulting in a full range of marks across Bands 1 to 4.

In this series, the following characteristics were often evident in the response from learners that gained lower marks for this activity:

- The solution generated - a) was a fairly minor improvement on the original clamping solution; b) showed some variation in form (rather than approach) when compared to the original clamping solution and may have included, for example, drilled through blocks acting as half clamps that were fastened into the T nuts, rather than spacers (a simple improvement); and c) was safer and generally slightly more effective than the original clamping solution.
- The annotation/notes/text - a) simply referred to existing products in a very generic sense, without providing any comments on how they were used when redesigning the clamping solution; b) referred to/considered just one non-optimal material for the chosen clamping solution (such as stainless steel), but sensible reasons for its use were normally stated; c) referred to/considered just one or two manufacturing processes, but they were generally suitable and some sensible reasons for their use were stated; and d) did not consider sustainability in an explicit/contextual fashion.
- Technical terminology was reasonably accurate throughout and the drawings/annotation/written text/notes would have allowed a competent third party to understand the solution, due to an appropriate level of communication in the aforesaid; for example, sub-titles were evident, and the drawings were reasonably straightforward to comprehend.

Conversely, the following characteristics were often evident in the response from learners that gained higher marks for this activity:

- The solution generated - a) was a clear improvement on the original clamping solution; b) showed a clear variation in form/approach when compared to the original clamping solution, for example it may have used four right angle blocks for accurate location/to prevent linear and angular movement, and quick release/toggle clamps to fix the pneumatic cylinder to the base plate; and c) was safer than the original clamping solution, as the new solution prevented unintended/uncontrolled movement of the pneumatic cylinder and may have been easier to fix/remove.
- The annotation/notes/text - a) referred to existing products from research in a specific manner, and it was normally evident how the features of different existing clamps/location aids were used in the chosen solution; b) referred to/considered different/optimal materials for the chosen clamping solution (such as low carbon steel) and gave suitable reasons for their selection; c) referred to/considered different/appropriate manufacturing processes (probably with reference to batch production) and gave suitable reasons for their selection; and d) mentioned sustainability at several points (but this may have been a weaker aspect of the response). For the latter, there should be consideration of, for example, raw materials extraction, material production, production of parts, assembly, use and disposal /recycling in the context of the chosen solution.
- Accurate technical terminology was used throughout, and the drawings/annotation/written text/notes would have allowed a competent third party to attempt to manufacture the new clamping solution, due to the aforesaid being 'effective'; for example, a suitably accurate orthographic projection was evident.

The following extracts show examples of some of the aforesaid characteristics (please refer to both parts of the Activity 4 marking grid):

In Extract 1, the learner has provided a solution that is a major improvement over the original clamping solution. There are some annotated comments that explain the features of the redesigned clamping solution to justify the change in form and approach. The idea has clearly 'designed out' most of the issues with the original clamping solution. This type of response is representative of Band 4 evidence.

In Extract 2, the learner has provided some comments that relate to an existing product (pipe shoes) that could be incorporated into a redesigned solution; however, this type of response is representative of Band 2 evidence, as the text only refers to the existing product and does not state/show how it could be used in the redesigned clamping solution.

In Extract 3, the learner has chosen a suitable machine/machining process to make their solution (milling machine/milling) and has provided an outline of what the said process can do; however, the text does not consider other options and lacks specific/contextual technical details that justify why the stated manufacturing process is suitable to make the redesigned clamping solution. As a result, this type of response is representative of Band 2 evidence.

In Extracts 4a and 4b the learners have provided effective drawings (with some detail) that, along with some further annotation/written text/notes/tables, would allow a competent third party to interpret how to manufacture the solution. These types of response are representative of Band 4 evidence (for the 'Design Documentation' sub-task).

Extract 1

Not to scale

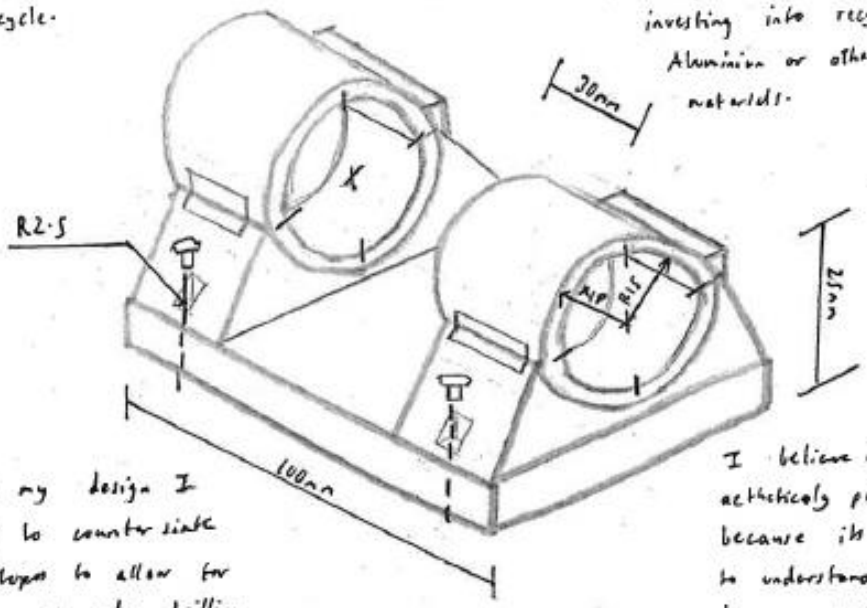
Compared to the original design its slightly more complex however I think its shape could still be easily produced by various method. CNC milling - Sand casting - Forging.

A finish isn't ~~actually~~ needed. You could use a plastic insert of ABS or PVC. Just to stop the two metals grinding. This should increase life cycle.

The locks is a double hinge system to provide friction throughout various points meaning its more likely to stay in its original position.

As before I have increase the thickness of the aluminium because it provides greater strength & durability. Therefore increasing its sustainability and overall life cycle.

Environmental impact can be improved by investing into recycled Aluminium or other materials.

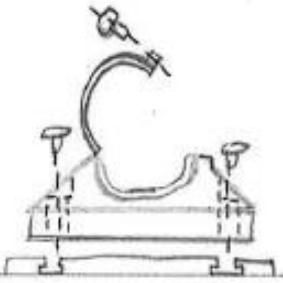


Due to my design I needed to counter sink the slopes to allow for easy access when drilling into T-nuts.

This clamp is thicker with a larger surface area to improve robustness & efficiency.

I believe it is aethetically pleasing because its easy to understand and has a neat locking system.

Not to scale



Ive placed an easy clip and hinge system to add quicke accessibility so maintenance time is more efficient.

It contains a thicke base and walls for strength so even when its working at 80m/s it still withstands the pressure.

Extract 2

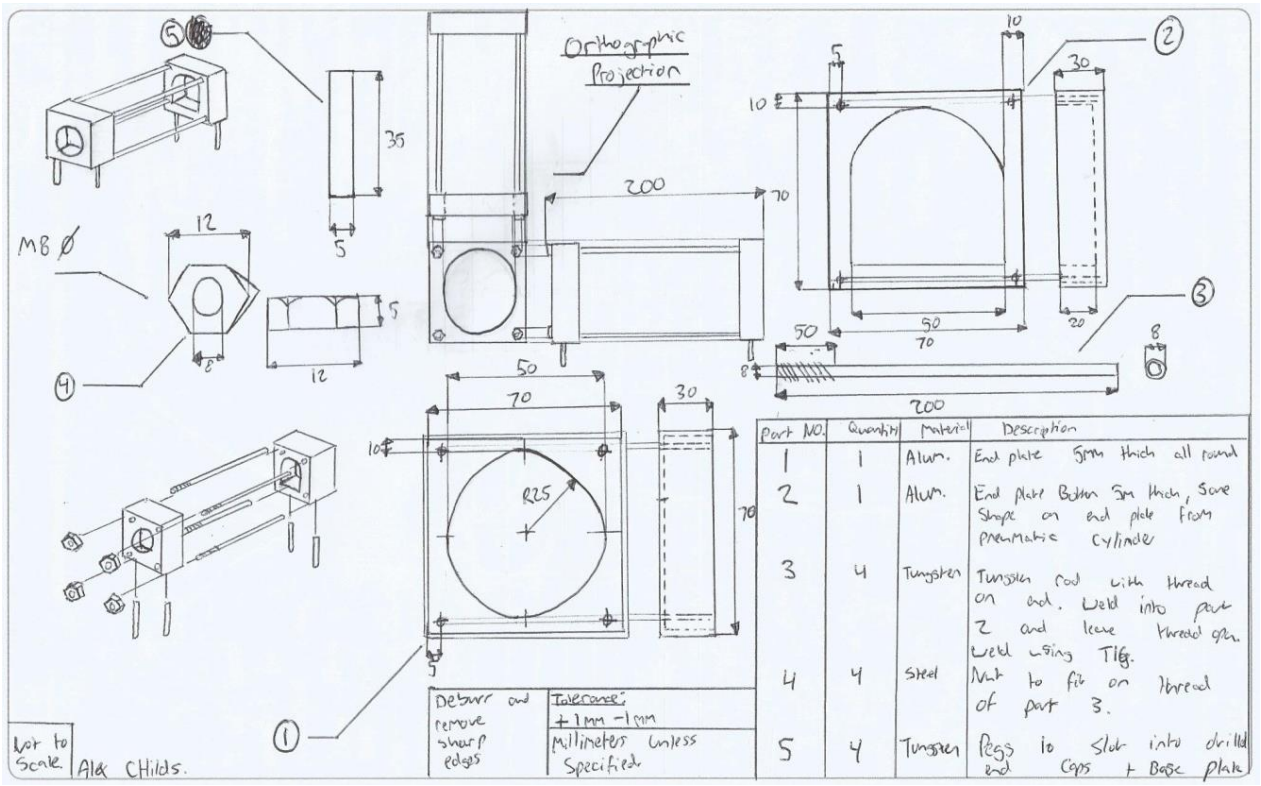
Existing Products:

~~Whilst res~~ The existing clamp is a very simple design and it's ineffective. Other existing products can be a solution to this situation. Products such as pipe shoes are very suitable and strong for this purpose with adaption it would fit for purpose.

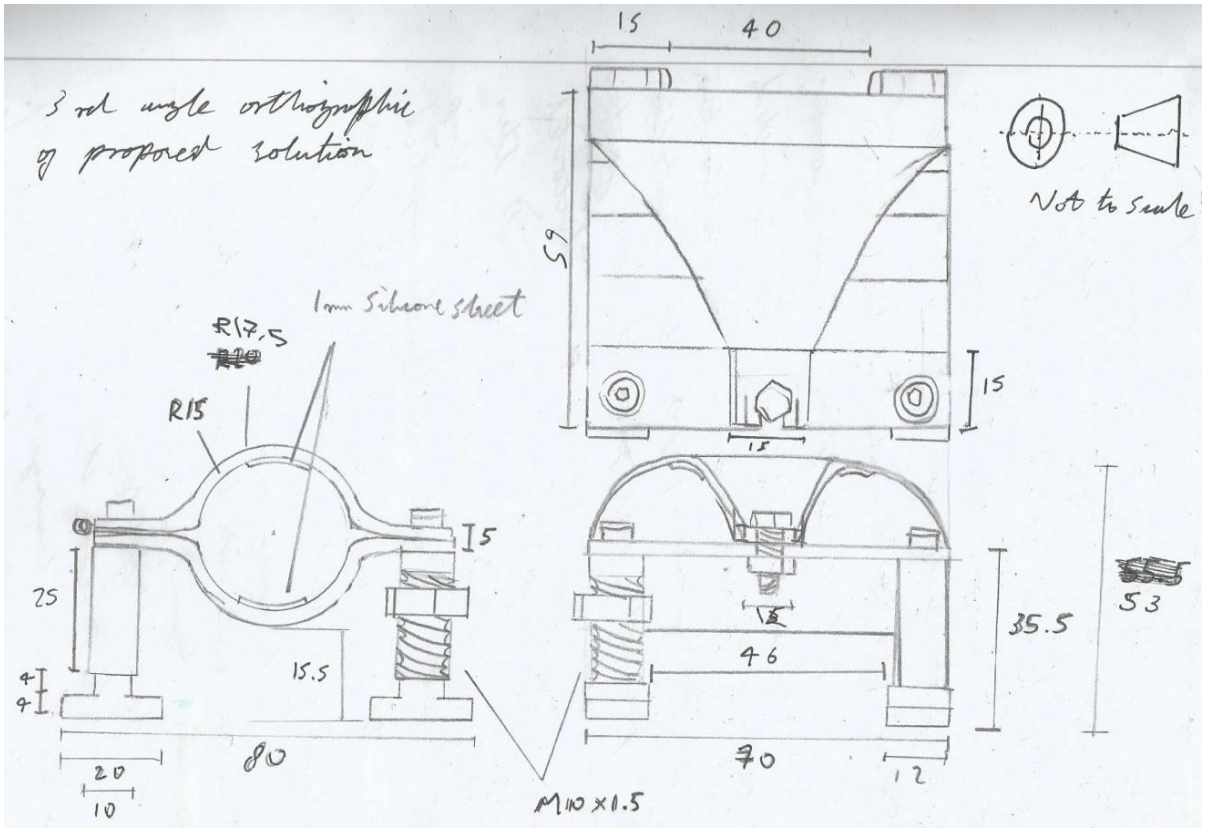
Extract 3

Milling Machines
Function: Used in making and shaping flat and irregular surfaces. Can also do other tasks such as drilling, routing, cutting gears.

Extract 4a



Extract 4b



The format of the assessment evidence provided for Activity 4 varied; nonetheless, the majority of learners that performed well on this activity:

- Provided a final design drawing of an optimised solution in isometric and via an orthographic projection
- Generated further drawings and detailed technical annotation (of all the drawings) as appropriate to ensure that the solution was communicated effectively and would allow a competent third party to interpret how to manufacture it
- Produced a series of relevant technical comments (with justification) under a series of sub-titles that related to their consideration/use of existing products, materials selection for different parts of the solution, manufacturing process selection for different parts of the solution and sustainability at all stages of the product life cycle

This type of format allowed learners to provide evidence that showed they had addressed each of the strands in the Activity 4 marking grid (both parts). **As Activity 4 is worth 30 marks from 60 marks available overall, learners should spend more time on this activity than any of the others** and must ensure that they address all of the bullet points stated in the task booklet in their response.

Activity 5 - Evaluate the design proposal

Activity 5 requires learners to evaluate their design proposal. Learners should reflect on their own solution (from Activity 4) in relation to the Part B Client brief and the original design (in this case, a clamping solution) and provide a rationale for why their new solution is more effective. The evaluation needs to consider several factors: the success and limitations of the solution; the indirect benefits and opportunities of the solution; and any constraints related to the solution. The evaluation should also reflect on how technology-led modifications could optimise the solution suggested. The assessment focus is 'Validating the design proposal'.
Again, the vast majority of learners attempted this activity and a wide range of responses were seen, resulting in a full range of marks across Bands 1 to 3.

In this series, the following characteristics were often evident in the response from learners that gained lower marks for this activity:

- The appraisal focused, in an explicit fashion, on why the new clamping solution was a success but sometimes referred to simplistic/generic/non-specific considerations, such as price/'strength'. Opportunities /limitations/ constraints /indirect benefits were normally not considered in detail, but some salient points were evident.
- The rationale gave some appropriate reasons as to why the new solution was considered more effective than the original clamping solution, but it was self-congratulatory in places and only referenced the five bullet points at the bottom of the Part B Client brief in an implicit fashion or to say they had been met.
- Comments on some further technology-led modifications were evident but they were very generic and/or irrelevant, for example, they referred to the use of additive manufacturing without stating why the application of the technology would be beneficial when manufacturing the new clamping solution.

Conversely, the following characteristics were often evident in the response from learners that gained higher marks for this activity:

- The appraisal focused, in an explicit fashion, on the successes, limitations/constraints and opportunities associated with the particular (new) clamping solution, for example 'Now that the clamping solution includes quick release clamps and a backing plate the movement of the pneumatic cylinder will be reduced but it seems unnecessary for it to be a separate item. The manufacturing company could source a pneumatic cylinder where the actuator assembly could be taken apart for maintenance meaning that the end caps could be welded to a smaller base plate, so the cylinder never moves.'
- The rationale gave good reasons as to why the solution was effective and referenced some of the five bullet points at the bottom of the Part B Client brief.

- Contextualised comments on some further technology-led modifications were evident and referred to, for example, sensors within location aids to monitor and respond to increased movement that could enable a warning light and/or disable the pneumatic cylinder actuator.

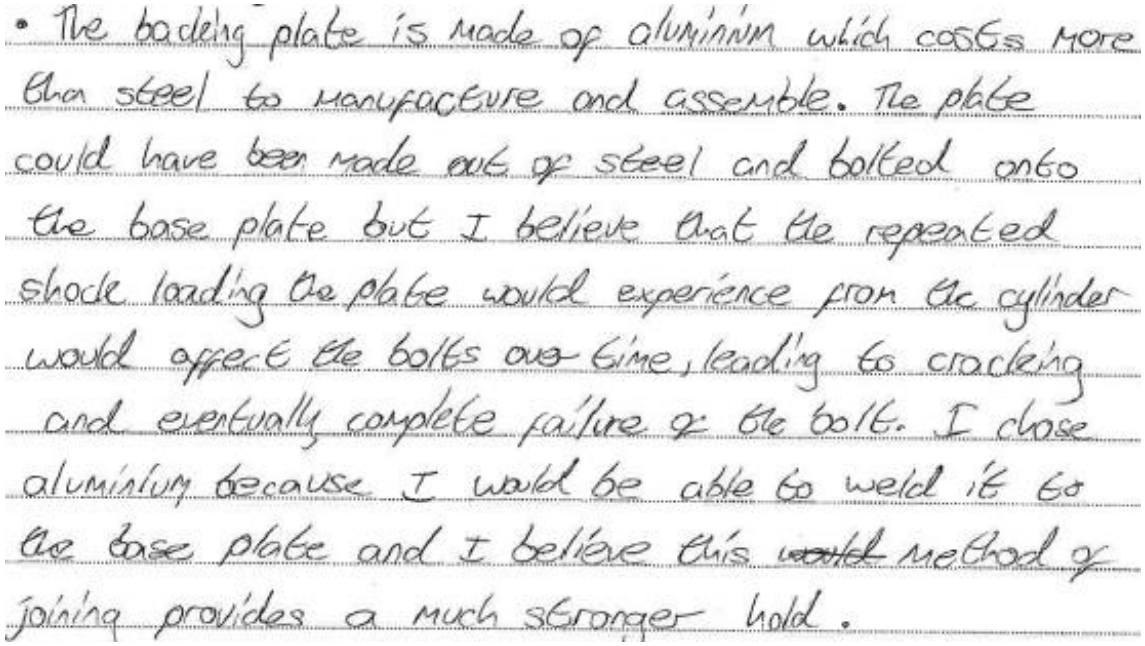
The following extracts show examples of some of the aforesaid characteristics (please refer to the Activity 5 marking grid):

In Extract 1, the learner has provided an appraisal of a possible constraint/limitation. The appraisal is particular to the solution itself and recognises the possibility of an issue that may arise after a certain amount of use if the said solution was assembled in a particular manner (and it therefore implicitly references bullet points 1, 3 and 4 at the bottom of the Part B Client brief). This type of response is representative of Band 3 evidence.

In Extract 2, the learner has provided comments that refer to the perceived successes of the new solution; however, the said comments generally just restate what was required for each of the activities or just repeat (using different words) some of the text in the Part B Client brief. In addition, the comment 'I had to keep the new design similar to the original product' is factually inaccurate. Detailed examples and/or justifications as to why the new clamping solution meets the stated product requirements are not evident. As a result, this type of response is representative of Band 1 evidence.

In Extract 3, the learner has referred to a possible technology-led modification, and they have provided some thoughts as to why this would optimise the clamping solution; in addition, the limitations of the possible modification are also considered. As a result, this type of response is representative of Band 3 evidence.

Extract 1


• The backing plate is made of aluminium which costs more than steel to manufacture and assemble. The plate could have been made out of steel and bolted onto the base plate but I believe that the repeated shock loading the plate would experience from the cylinder would affect the bolts over time, leading to cracking and eventually complete failure of the bolt. I chose aluminium because I would be able to weld it to the base plate and I believe this ~~would~~ method of joining provides a much stronger hold.

Extract 2

Success and Limitations:

When it came to designing the product solutions, I believe it was a success as I was able to use new materials and come up with my own designs this allowed me to be creative. However, a limitation of the design was being unable to completely change the pneumatic cylinder, this meant that I had to keep the new design simular to the original product, I also had to think of new ways to help stabilise or reduce the movement of the pneumatic cylinder when it was running. Overall, I have been able to create a sustainable and simple clamp for the pneumatic cylinder.

Extract 3

Opportunities for technological modification:

If cost was no object, a powerful electro magnet could be used to keep the clamp stuck to the table. This would ensure little to no horizontal movement, this would however increase power usage and require a more skilled worker to carry out maintenance. The use of this may also be more dangerous for the maintenance worker as electricity may pose a threat to them and thoughs near by.

The format of the assessment evidence provided for Activity 5 varied; nonetheless, the majority of learners that performed well on this activity provided a series of relevant comments (with justification) under a series of sub-titles that related to:

- The successes and limitations of their solution (with reference to the Part B Client brief and/or the issues and operational requirements highlighted in Activity 2)
- The indirect benefits and opportunities resulting from their chosen solution
- The constraints of their chosen solution
- Further technology-led modifications

This type of format allowed learners to provide evidence that showed they had addressed each of the strands in the Activity 5 marking grid. As Activity 5 is worth 9 marks from 60 marks available overall, learners should provide an overall response that includes some detail.

Summary

Based on the outcomes and performance of learners for this task, learners in subsequent series should:

Activity 1

- Link forward planning to the specifics of the product being redesigned, based on a consideration of what has happened in previous sessions (this must not be generic and should not simply reiterate the statements underneath the activity headings in the task booklet).
- Provide explanations/justifications for the specific changes made during each session in order to fulfill the requirements of the Part B Client brief.

Activity 2

- Use their conclusions from the interpretation of numerical data to suggest some justifiable product requirements.
- Generate a series of relevant, contextualised comments in bullet point form under a series of sub-titles related to product requirements, opportunities /constraints, health and safety and regulatory/sustainability factors, and ensure they are justified in relation to the issues and operational requirements identified from the Part B Client brief.

Activity 3

- Sketch three or four different and fit for purpose proposals in isometric that address all of the aspects in the Part B Client brief and provide further drawings/views dependent upon the idea being communicated.
- Use annotations (not labels) to explain the ideas and refer to the five bullet points at the bottom of the Part B Client brief.

Activity 4

- Generate drawings and detailed technical annotations as appropriate to ensure that the most suitable solution is communicated effectively and would allow a competent third party to interpret how to manufacture it.
- Produce a series of relevant, contextualised technical comments (with justification) under a series of sub-titles that relate to the consideration/use of existing products, materials selection for different parts of the solution, manufacturing process selection for different parts of the solution and sustainability at all stages of the product life cycle.

Activity 5

- Provide a series of relevant, contextualised comments (with justification) under a series of sub-titles related to the successes and limitations of their solution (with reference to the Part B Client brief and/or the issues and operational requirements highlighted in Activity 2), the indirect benefits and opportunities resulting from their solution, the constraints of their solution and possible technology-led modifications.

The specifications for the 2016 Level 3 BTEC Nationals in Engineering are available from:

Specifications

The Sample Assessment Materials (SAMs) for Unit 3 are available from:

Sample Assessment Materials

The tasks and Examiners' Reports for Unit 3 from previous series are available from:

Tasks and Examiners' Reports

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