

L3 Lead Examiner Report 1901

January 2019

L3 Qualification in Engineering

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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:

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Unit 3: Product Design and Manufacture

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	8	17	29	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 fourth live task for this unit and learners were required to redesign a retractable key.

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 of the examples of learner assessment evidence provided in this report are extracts. As a result, they can only be considered to be representative of evidence that would be awarded a mark from a certain band. In reality, all of 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. 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 vast majority of learners appeared to find the task accessible. The examiners were able to award a full range 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 (and in comparison, with the previous series, there were more isometric drawings with explosions and more reasonable attempts at orthographic projections for Activity 4, 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 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 for a retractable key. In general, there were some generic and/or specific comments about the features of existing retractable keys in the assessment evidence for Activity 4; however, actual sketches or diagrams showing how certain features (of existing retractable keys) had been incorporated into the learner's solution were seen infrequently. In addition, it was not clear that learners had researched sustainability at all stages of the product life cycle, as again most responses simply focused on recycling. Nonetheless, it was 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 fulfil 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:

Activity	Time	What I intend to do	Marks	Changes which were made
1	48 min	- Create an outline for the Project plan - Why changes were made at each stage. - Things to do in next session	6	Began thinking of alternate designs, what has been missed compared with existing models of key

During activity 2 I found that I had to spend longer than half an hours. So I spent 1 hour 30 minutes on its activity 2.

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 (a retractable key in this case). In Extract 1, the plan is more detailed for Activity 3 but 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 of time 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 3 (in an upcoming session) that relates to the Part B Client brief and their previous interpretation activities. This type of response is representative of Band 3 evidence.

- 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 some suitable reasons for the changes made to an initial design idea during Activity 4. This type of response is representative of Band 3 evidence.

Extract 1 - An initial outline time plan for one session

Date/Time	Activity 3	Outcome	Source of information
16/01/2019 1:30mins	Today's session, I'll be making producing 3 sketches which are my initial design ideas of the retractable key. I will also produce a detailed annotation on the drawings which will include labels and explanation of the materials and manufacturing processes used to redesign the product.	I've draw the 3 ideas of a retractable key which are addressing the problems and requirement in the brief of the client.	Research Online Research Client's brief

Extract 2 - An action point for an upcoming session

I have determined that I will use thicker channels and make the key blade out of nickel silver, to have a more stable ^{key} ~~design~~ that is not easily snapped. I have to also think about safety factors and possibly add on ^{new} ~~other~~ features such as a lock, that may help it become safer.

Extract 3 - Changes made during the session

A: I added a spring into my design, so therefore the user doesn't have to manually pull the key out, it makes it more practical.

Also, I have flipped the key around, so the jagged edge doesn't stick out when it's folded away, resulting in a safer product.

Finally I added a key binder in so other keys can be attached, for practical purposes.

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 suitable interpretation/conclusions resulted from a review of the data in Table 1.
- The consideration of health and safety factors was very 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 store, hold and release the key blade using a mechanism that would make sure it is never loose so it can't fall out of the casing and so it can be fully hidden so there is no possibility of damage to it.'
- Actual calculations were normally present and conclusions followed from them; in addition, further comments interpreted/articulated how the results could be used to improve the design for the modified product, for example by noting that nickel silver appeared to be the most appropriate key blade material, or that by removing the key blade channels from the redesign it may improve durability.
- Sustainability factors were normally considered; in addition, health and safety factors were commented on in context and again often extended the Part B Client brief, for example 'It would be better to have a release mechanism other than a pawl (using a stiff spring) as there is always a possibility that the user's finger or thumb may slip during use.'

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 made reasonable comments, with some justification, about a possible method/mechanism that may result in the redesigned retractable key being easier/more safe to use/handle (enhanced product performance). This type of response is representative of Band 3 evidence.
- In Extract 2, the learner has used their calculations (based on Table 1 in the Part B Client brief) to determine requirements that may allow the retractable key to be more durable 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; however, the said comments are mostly generic and would apply to virtually any consumer product. This type of response is representative of Band 1 evidence.

Extract 1

The mechanism can also be changed to reflect that of a retractable knife. This mechanism utilizes a grip that must be pushed in and moved up, slowly revealing the item that was previously retracted. This option is much safer to use as it would be harder for kids to grip and doesn't retract or reveal the key blade too quickly so that the user will not be harmed. Retracting it would be easier as well, because the grip only needs to be moved down again, without having to touch the key blade. However, the side of a small slot will need to be cut out from the side of the job for this mechanism.

Extract 2

Interpretation of numerical data.

As the key blade channels get wider the average lifetime of the key increases. On average the 1mm channels last 2.95 years, the 1.5mm channels 4.62 years and the 2mm channels 6.375 years. This leads me to believe that widening the channel enough could help in making the product last to ~~12~~ ¹⁷ year extended 12 year life.

In each category of channel thickness the spring stiffness also affects the life of the key. The keys with a stiffness of 85Nm⁻¹ on average have a shorter life than those at 62 Nm⁻¹ making this the optimum value.

Extract 3

*⁶ In addition to health and safety regulations during manufacture, health and safety must also be considered during the design phase this is because designs that want to be considered must follow British Standards and carry the CE mark, this gives a reassurance of quality manufacture and design so users know it's safe.

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 based on the numerical data and then provided some comments/conclusions to interpret the results and suggest some 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 existing retractable key (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 width and thickness of the fob could not be above the sizes stated in the Part B Client brief, and/or did not secure the key blade so it could not fall out of the fob (a relatively straightforward improvement);
- 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 existing retractable key and each other, when considering both form and approach; in addition, they included adaptations that were major improvements when compared to the existing retractable key 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 the width and thickness of the fob could not be above the sizes stated in the Part B Client brief and included improved features related to, for example: location (e.g. storage of the key blade when not in use); b) size (e.g. reducing the length of the bottom section of the key blade); and c) the key blade release and secure method/mechanism (e.g. ease of use/durability/reliability to enable the key blade to turn in a lock).
- 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, some generic/irrelevant comments about aspects such as aesthetics and extensive explanations related to manufacturing processes (which is a focus of Activity 4) were evident and gained no/less credit.

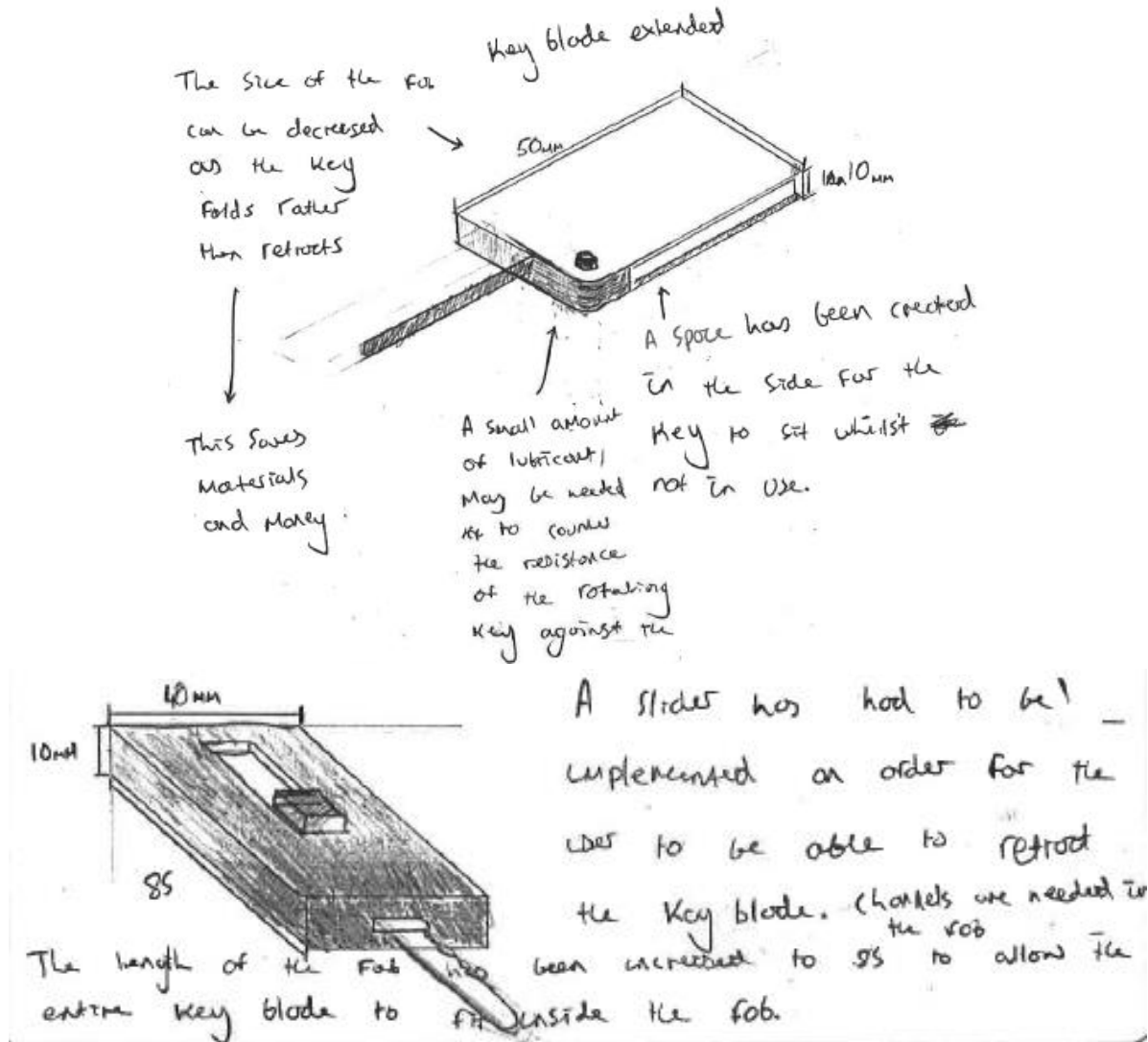
The following extracts show examples of some of the aforesaid characteristics (please refer to the Activity 3 marking grid):

In Extracts 1a and 1b, the learner has generated ideas that comprehensively address the Part B Client brief and, although they are not perfect, they both include features that are major improvements when compared to the existing retractable key. In addition, they are both generally feasible and fit for purpose, and different to the existing retractable key, 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 some features that are minor improvements (for example, a small spring at the bottom of the key blade channels) when compared to the existing retractable key; in addition, some of the written comments provide some simple contextual thoughts when considering some basic product requirements that are evident from the Part B Client brief. Nonetheless, the idea is still very similar to the existing retractable key and therefore this type of response is representative of Band 1 evidence.

Extracts 1a and 1b



Extract 2a and 2b

This sliding mechanism means the key doesn't need to be pulled out which reduces risk of injury.

- slider grip at top of key unlike the pawl in the initial design. easier to use.

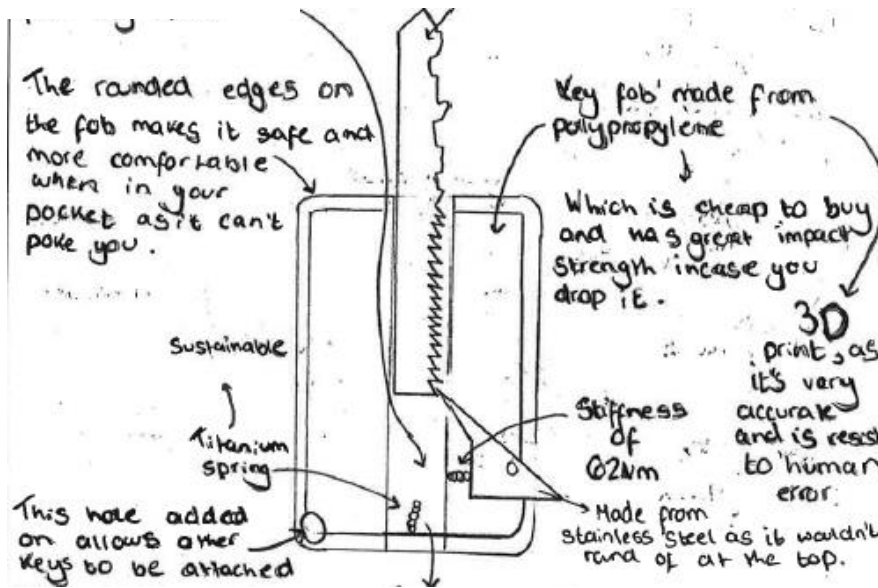
The key not fall out due to the 'T' lock at the end of the blade.

also adding comfort when holding it in your pocket.

↓

This spring is compressed when the key is locked down and then pops the key up when the pawl is pressed, instead of having to do it manually.

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 existing retractable key; b) showed some variation in form (rather than approach) when compared to the existing retractable key and may have included, for example, a spring/location pin at the bottom of the key blade channels so the key blade itself was easier to grip/secure for/during use (a simple improvement); and c) was safer and generally slightly more effective than the existing retractable key.
- 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 retractable key; b) referred to/considered just one non-optimal material for the key blade (such as stainless steel), but sensible reasons for its use were stated; c) referred to/considered just one or two manufacturing processes, but they were suitable and sensible reasons for their use were stated; and d) did not consider sustainability in an explicit 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 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 existing retractable key; b) showed a clear variation in form/approach when compared to the existing retractable key, for example it may have been shorter and the release/secure mechanism may have enabled the blade to be flipped or slid/locked into place for use/storage; and c) was safer than the existing retractable key, as the solution was likely to prevent unintended/uncontrolled movement of the key blade.
- The annotation/notes/text: a) referred to existing products from research in a specific manner, and it was normally evident how the features of a different existing retractable key(s) were used in the chosen solution; b) referred to/considered different/optimal materials for the key blade (such as nickel silver)/the other parts of the redesigned retractable key, and give suitable reasons for their selection; c) referred to/considered different/appropriate manufacturing processes 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 solution, due to the aforesaid being 'effective'; for example, a reasonably 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 existing design of retractable key. There are some annotated comments that explain the mechanism and features of the redesigned retractable key to justify the change in form and approach. The idea has clearly 'designed out' most of the issues with the existing retractable key. This type of response is representative of Band 4 evidence.

In Extract 2, the learner has provided suitable comments that relate to the specific features of an existing product that could be applied to the redesigned solution; in addition, the comments have been used to inform the proposal as some of the

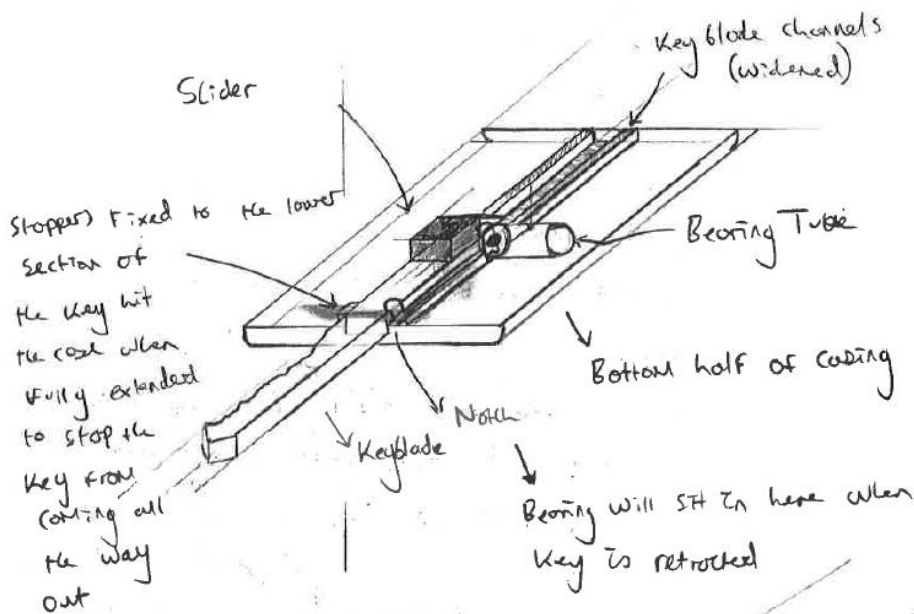
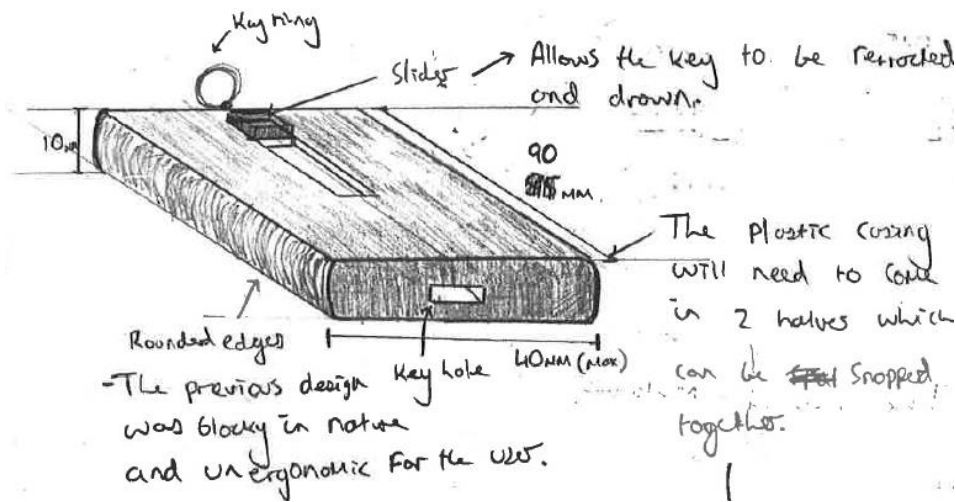
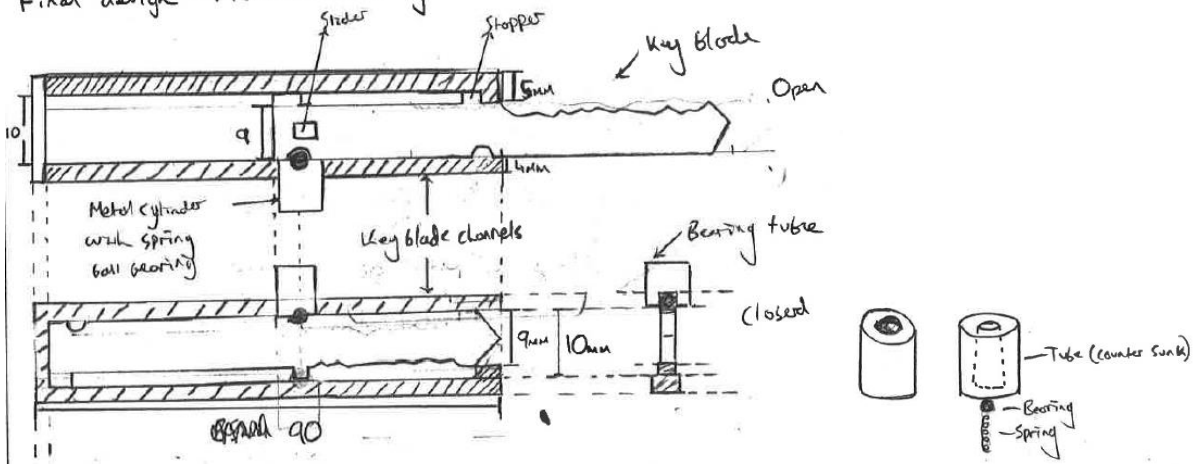
features are evident in the solution shown in Extract 4a. This type of response is representative of Band 4 evidence.

In Extract 3, the learner has chosen a suitable manufacturing process for their solution (injection moulding for the fob) and has provided an outline of how the said process operates; however, the text does not consider other options and lacks specific technical details that justify why the stated manufacturing process is suitable for the solution. As a result, this type of response is representative of Band 2 evidence.

In Extracts 4a, 4b and 4c, the learners have provided reasonable drawings (with some detail) that, along with further annotation/written text/notes/tables, would allow a competent third party to interpret how to manufacture the solution (irrespective of how effective the solution actually is). These types of response are representative of Band 3 evidence (for the 'Design Documentation' sub-task).

Extract 1

Final design - Mechanism drawing.



Extract 2

Existing Products :

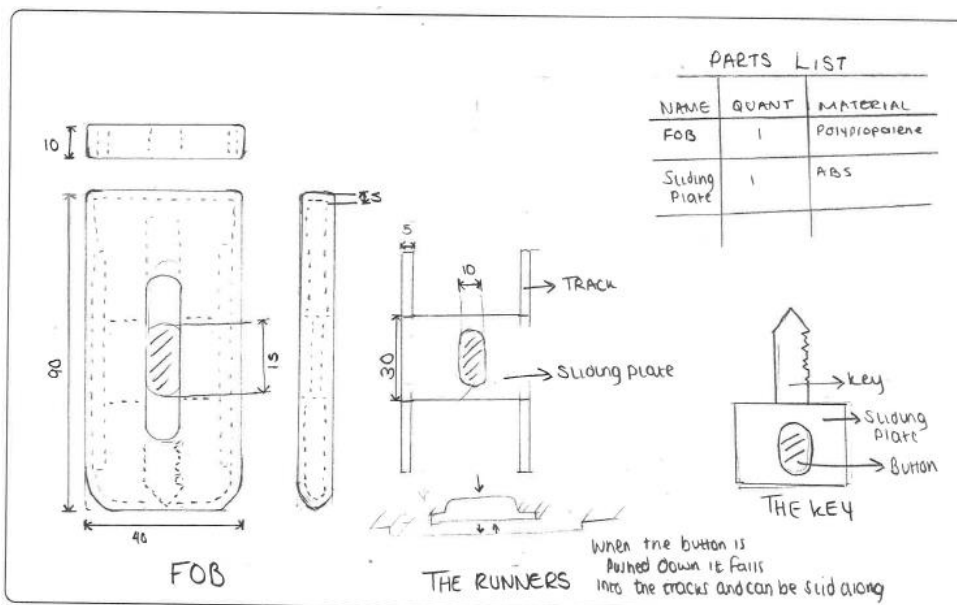
While designing the product I carried out research to discover what was currently on the market and learn about existing products that worked in a similar way. From my research one product I discovered that worked in a suitable way was a Stanley knife, this is because the method to pressing the button to uncover the blade is like getting the key out. In addition it also has similarities concerning the user. The user will want the knife to be safe in transport by the blade being covered this is like the end of the key being hidden. Also the knife must be easily operated by hand and comfortable for the user, this is the same as our key.

When making my design I deconstructed a Stanley knife to see how it worked and now I could adapt it to the key fob.

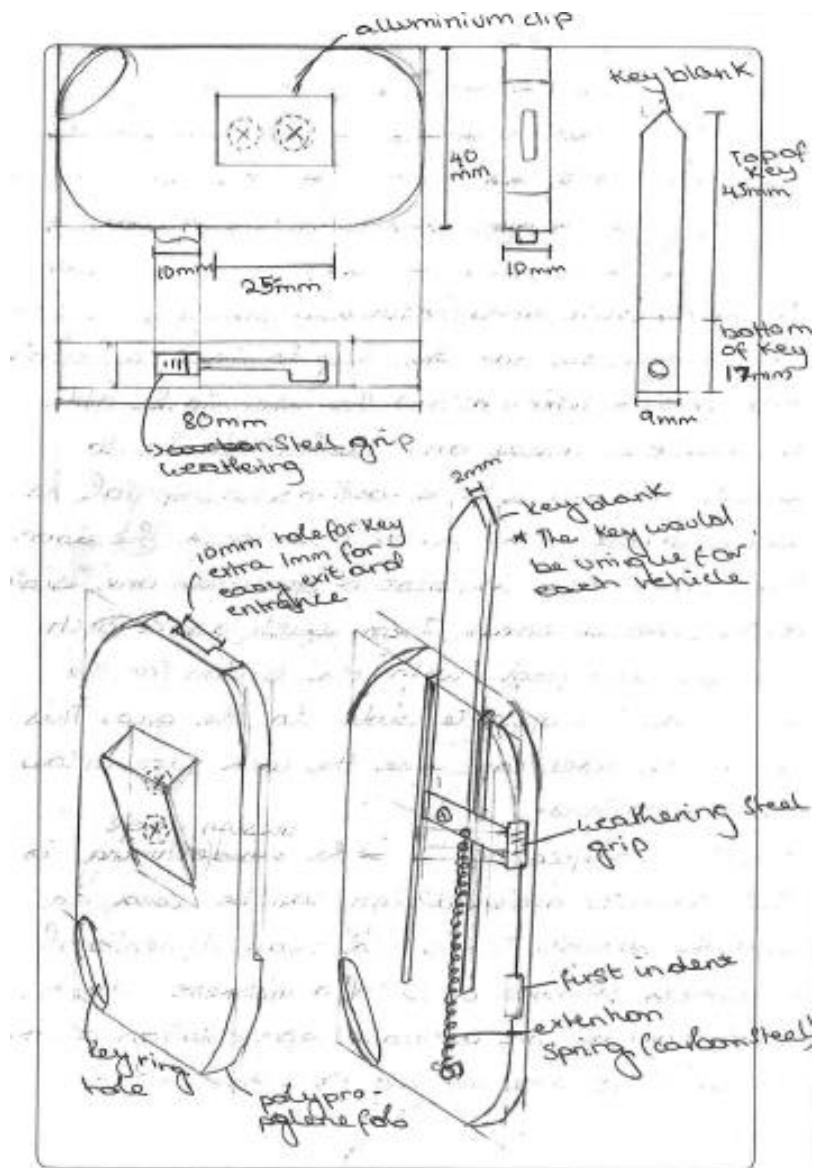
Extract 3

Injection Moulding This is a moulding process which involves melting plastic pellet which once ~~made~~ malleable enough, is injected at pressure into a mould cavity which fills and solidifies to produce a final product. When the polypropylene is melted, it is then poured into the moulded fob at high pressure (hot) and after some seconds moved automatically to a cooling session for it to cool. After solidification, the fob is then removed from the mould and sent to further processing. This process is very cost-effective because it can produce large number of fobs for the keys.

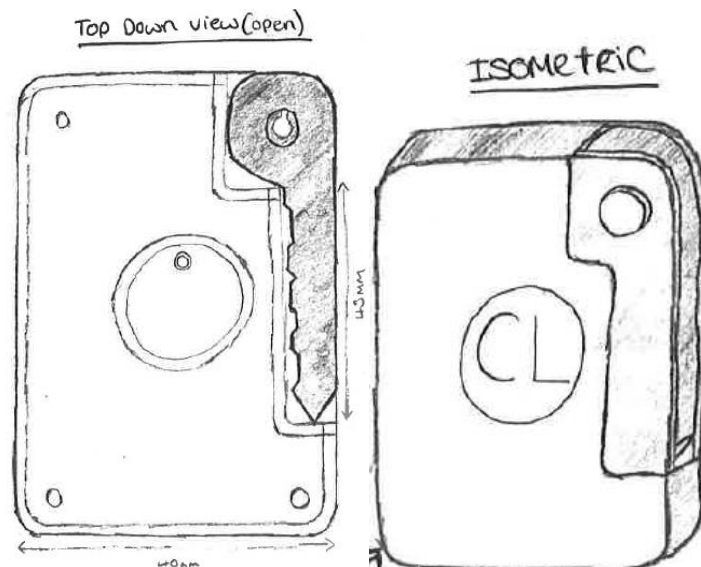
Extract 4a



Extract 4b



Extract 4c



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 retractable key) and provide a rationale for why their 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 design 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 solution was considered more effective than the existing retractable key, 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 solution for a new retractable key.

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 design solution, for example 'Now that the retractable key uses a spring to flip the blade into place and back again it will be much easier to use and more effective; however, it also means there are more moving parts needed and they may wear/get dirty over time, meaning the mechanism could break or fall apart. There may be an opportunity for some of the individual parts to be combined into bigger moulded parts using injection moulding or forging, rather than

being assembled, so less can go wrong. This would mean the retractable key would be more durable over time and is more likely to last for the expected life cycle.'

- 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: a) the use of smart materials to provide lighting as part of the fob; b) satellite technology so the retractable key could be found easily; and c) heating elements so that the blade could be inserted into locks in cold weather.

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 possible limitation. The appraisal is particular to the solution itself and recognises the possibility of an issue with the design that may become apparent after a certain amount of use (and it therefore implicitly references bullet point 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 an initial rationale that explains why their solution is more effective when compared to the existing retractable key. The rationale is particular to the solution itself and references, in an implicit fashion, at least two of the five bullet points at the bottom of the Part B Client brief. This type of response is representative of Band 3 evidence.

In Extract 3, the learner has provided comments that refer to the successes of the solution; however, the said comments generally just repeat (using some different words) some the statements in the bullet points at the bottom of the Part B Client brief. Detailed examples and/or justifications as to why the solution meets the stated product requirements are missing. As a result, this type of response is representative of Band 1 evidence.

Extract 1

The key hole has been left open when the key is retracted.
This over time could cause ~~material~~ material to gather in
the open space when the key is away. A small rubber
flap could be added to eliminate this issue.

Extract 2

I believe that my designed product has a variety of successful success as I have solved numerous problems that were stated by previous owners of the original key design. I have made my design easier to use than previous as my pawl lever triggers the spring to unlock the key blade without hand assistance. This is in comparison to the original design, whereby it was difficult to pull out and get a grip of the blade.

A second complaint highlighted the vulnerability of the blade by its habit tendency to snap and bend away from the lower section of the key. In order to reduce this from happening, as often my design includes a thicker mid-section that separates the exposed blade from the pole and hidden part of the blade. This larger volume of material will require more tension and pressure for it to snap. Therefore, its larger volume compared to the original design ensures that it will not bend and snap so easily.

Extract 3

- The top section of the key is able to be inserted into and open a lock.
- I have designed a very effective method of storing the key with my flip and lock mechanism.
- The materials and processes I have chosen makes my key and key job very robust so it will last the wanted 12 years - It also stops the problem of the key snapping.
- It is easily capable of being manufactured in batches of 10,000 as I have chosen smart processes and materials.

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 solution
- The constraints of their 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.

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