

# **L3 Lead Examiner Report 2001**

January 2020

Level 3 Nationals in Engineering

Unit 3: Engineering 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 should be for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades that 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 test, 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: Engineering Product Design and Manufacture

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	9	19	30	41

## 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 sixth live task for this unit and learners were required to redesign a bracket for a modular induction motor system.

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. 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 suitable 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.

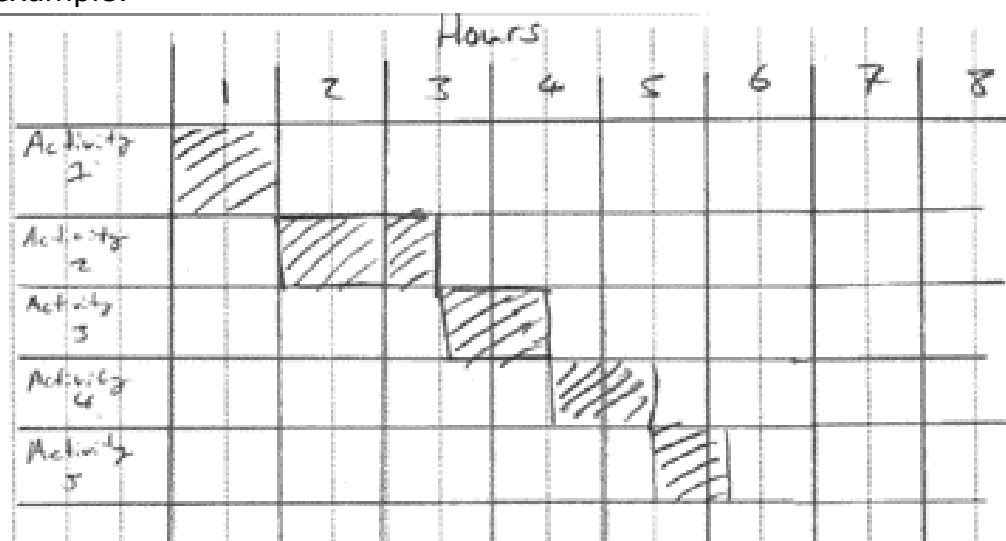
Similarly, the sketches/drawings provided by learners varied in quality; however, most were legible, drawn in three dimensions and communicated the proposals/solution to a suitable standard. For example, isometric drawings with explosions and reasonable attempts at orthographic projections for Activity 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 for brackets. In general, there were some generic and/or specific comments about the features of existing brackets in the assessment evidence for Activity 4; however, actual sketches or diagrams showing how certain features (of existing brackets) 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 and/or re-use. 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:



what changes were made during each session:

- developed 3 new redesigns of the current product (session 1)
- developed final idea during session 2, was a mix of a couple initial ideas

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 bracket for a modular induction motor system). In Extract 1, the overall plan includes more detail than the Gantt chart above but is still very 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 an action plan for an upcoming session; however, this type of response is not representative of Band 3 evidence as the said plan could be for any product and lacks specific content related to the redesign of the bracket. For example, a statement such as 'I will take features from my designs in Activity 3, such as the platform extension and lips, angle supports and anti-vibration pads forward and combine into a better final solution, as they will mean the product can meet the client brief' would be 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 adding extra features to their designs as part of Activity 3. This type of response is representative of Band 3 evidence.

Extract 1 - An initial outline time plan

Activity 1	Activity 2	Activity 3	Activity 4	Activity 5
	Interpret the client brief	Produce sketches for initial ideas of new bracket	Further develop one of initial ideas into a final product	Evaluate on the positives and negatives of the final product
	45 mins	1hr 15min	4hr	1hr 15min

Extract 2 - An action plan for an upcoming session

Action plan for next session

In the next session I will use my initial planning and ideas to develop a final design for my product and analyse the design considering costs, sustainability and the best uses of materials and manufacturing processes for producing it.

Extract 3 - A change made during a session

Activity 3 - I have added a 3rd bolt x to my designs as it will provide extra security with the wall plate and the mounting bolt mounting. This means that weight should not contribute to the bracket bending. I have also added a foam layer on top of the platform to absorb vibrations from the induction motor.

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 a basic (or sometimes inaccurate) interpretation/conclusion was evident based on a simple review of the data in Table 1.
- The consideration of health and safety factors was generic/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, 'The redesigned bracket should include a method to reduce vibration (maybe rubber plates?) so it is less likely that the enclosure will move as much as it does now, and some form of support for the bracket angle from above or below or both, so it is less likely to fracture during use.'
- Some straightforward calculations or graphs were present; in addition, suitable interpretations/conclusions followed from them, for example, 'The mass of the rotating attachment has the greatest impact on lifecycle, followed by the speed of the driveshaft and then the type of bracket material. I can't change the first two, but from this it seems that...' etc.
- 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 'As the enclosure has to be placed in or on the bracket the redesign should avoid finger traps, possibly by including finger grooves, and it could include methods to increase its visibility so that users know how to properly fit the enclosure onto it.'

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 possible product requirements (that are specific to the bracket) in relation to three of the five bullet points at the bottom of the Part B Client brief. This type of response is representative of Band 3 evidence, as the requirements are cohesive and consider enhanced product performance.
- In Extract 2, the learner has taken the data from Table 1 (in the Part B Client brief) and has generated an accurate mean average for the amount of years that Brackets A to F would last; however, no interpretation of the data is present. This type of response is representative of Band 2 evidence; for Band 3, the learner needs to generate an accurate conclusion from an interpretation of the data, with some indication of how the said conclusion might affect the redesign in a positive way.
- In Extract 3, the learner has made some comments about a health and safety factor that (potentially) has some relevance to the product in hand; however, the said comments are still generic and just focus on the use of Personal Protective Equipment. This type of response is representative of Band 1 evidence.

#### Extract 1

##### Product Requirements

The client has asked for a redesign ~~as~~ because he wants improvements to be made to the design. ~~he~~ In his requirement list he has asked for the redesign to have a more ~~to~~ secure mounting method on the wall which is possible through the use of screw or welding or many other methods, he has also asked for the bracket to be able to confidently support the motor meaning I must use an extremely ~~hard~~ heavy duty material or I must ~~use~~ install a support system for the bracket for it to maintain its shape in case any pressure is add on ~~to~~ it. In the client requirements he want to bracket to have no interference with accessing the motor's drive shaft meaning I must ensure there is no restriction to any access point on the motor.

### Extract 2

The Graph Shows that : 'A' Functioning at 2000 rev/min<sup>1</sup>/kg would last an avg of 2 years  
 'B' functioning at 2500 rev/min<sup>1</sup>/kg would last an avg of 2.63 years  
 'C' functioning at 2900 rev/min<sup>1</sup>/kg would last an avg of 3.13 years  
 'D' functioning at 4666 rev/min<sup>1</sup>/kg would last an avg of 4 years  
 'E' functioning at 6666 rev/min<sup>1</sup>/kg would last an avg of 4.63 years  
 'F' functioning at 10000 rev/min<sup>1</sup>/kg would last an avg of 6 years

### Extract 3

the health and safety factors of both the product and processes are a crucial aspect of the brackets manufacture. when the bracket is being produced in the workshop it is vital that the correct PPE is worn. For example if a person is doing any welding they must wear a welders mask, anyone who is doing any machining or presswork must wear goggles

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 bracket (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 bullet points at the bottom of the Part B Client brief.
- The initial design ideas did not take into account that the enclosure could not be redesigned and/or did not include suitable support for/triangulation of the bracket platform (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 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, fit for purpose and reasonably different to the original bracket design and each other, when considering both form and approach; in addition, they included adaptations that were major improvements when compared to the original bracket and at least three/four of the bullet points at the bottom of the Part B Client brief.
- The initial design ideas took into account that that the enclosure could not be redesigned (as stated in the Part B Client brief) and included improved features related to, for example - a) triangulating the bracket platform from above and below, with the angle support/s extending to/beyond the boss; b) the rigidity of the overall bracket structure (for example, by including supporting bars to attach the left-hand and right-hand brackets together); c) non-structural anti-vibration measures; and d) the security of the enclosure on the bracket (for example, by including lips).

- The annotation was technically accurate and covered the learner’s thoughts/rationale about each design idea with some reference to four of the 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.

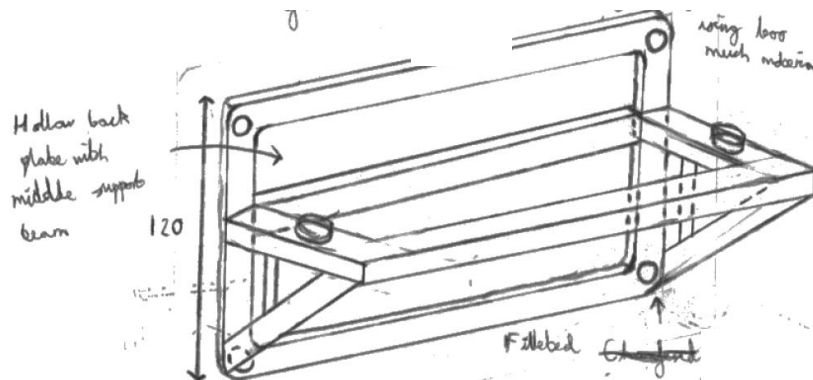
The following extracts show examples of some of the aforesaid characteristics (please refer to the Activity 3 marking grid):

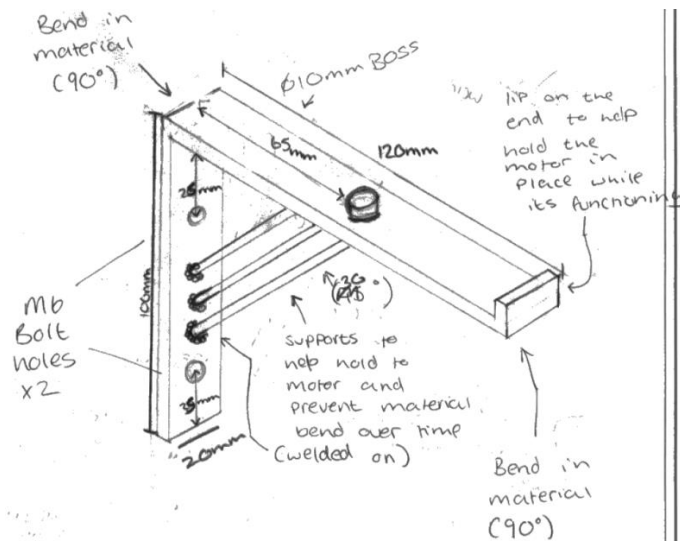
In Extracts 1a and 1b, the learners have generated ideas that comprehensively address the Part B Client brief and, although not perfect, they both include features that are major improvements when compared to the original bracket. In addition, they are both generally feasible and fit for purpose, and different to the original bracket, 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 (a third wall plate bolt) when compared to the original bracket; nonetheless, the idea is still very similar to the original bracket and therefore this type of response is representative of Band 1 evidence.

Extracts 1a and 1b





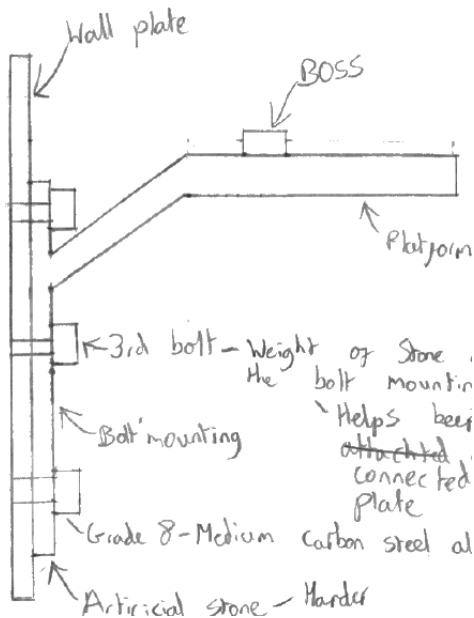
Extract 2a and 2b

The use of ~~cross~~ angled Rib in order to help the main structural integrity of the initial design to help nullify the risk of bending or Fracturing

→ The bracket contains an overhang on the platform to secure the motor enclosure

→ The platform is held up using an angled support from below.

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 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 consist of 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 bracket; b) showed some variation in form (rather than approach) when compared to the original bracket design and may have included, for example, an extension to the bracket platform and bolt mounting welded into the 'missing corner' (a simple improvement); and c) was safer and generally slightly more effective than the original bracket design.
- 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 bracket; b) referred to/considered just one non-optimal material for the chosen bracket (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 bracket; b) showed a clear variation in form/approach when compared to the original bracket design, for example it may have connected the left-hand and right-hand brackets into a single structure, and/or provided suitable support for the platform from different angles and/or included a slightly smaller diameter boss that could be capped with a replaceable cover made from nylon or rubber; and c) was safer than the original bracket, for example by preventing unintended movement of the enclosure when the motor is in use due to its structural integrity.
- 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 brackets/products were used in the chosen solution; b) referred to/considered different/optimal materials for the chosen bracket (such as medium carbon steel) and gave suitable reasons for their selection; c) referred to/considered different/appropriate manufacturing processes (probably with reference to batch/mass 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 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):

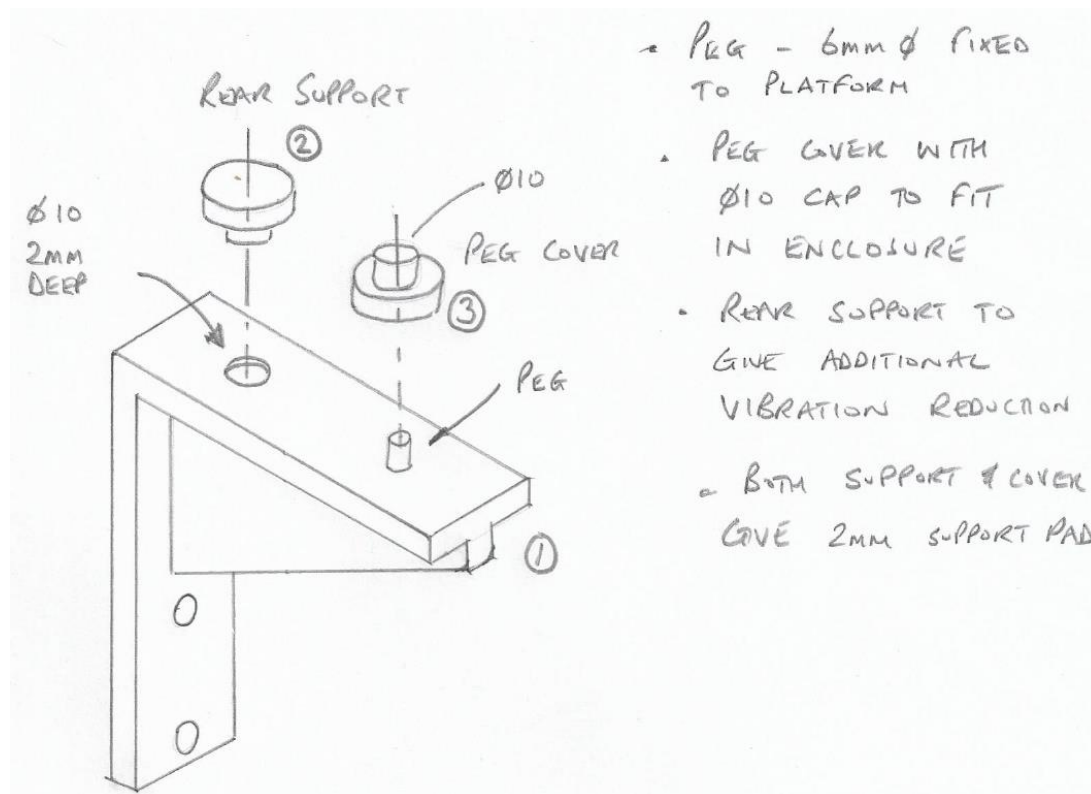
In Extract 1, the learner has provided a solution that is a major improvement over the original bracket design. There are some annotations that reference the anti-vibration feature of the redesigned bracket; this addresses an issue stated in the Part B Client brief. The idea has clearly 'designed out' most of the issues with the original bracket. This type of response is representative of Band 4 evidence.

In Extract 2, the learner has provided a brief comment about existing brackets and how a feature from them is incorporated into the redesigned solution; however, this type of response is representative of Band 2 evidence only, as the text lacks specificity in relation to how the feature has been used in the redesign.

In Extract 3, the learner has chosen a manufacturing process (die casting) to make their solution and has provided an outline/generic description of the process; 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 bracket. As a result, this type of response is representative of Band 1 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



### Extract 2

#### Existing Products

the final design is loosely based on some already available brackets, with them giving inspiration for the supports on the bottom of the brackets

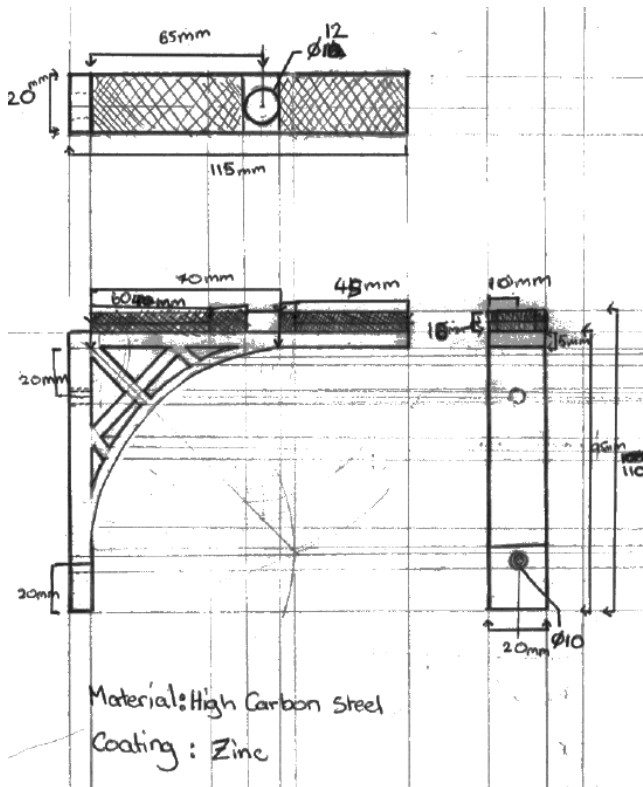
Extract 3

Zinc die casting.

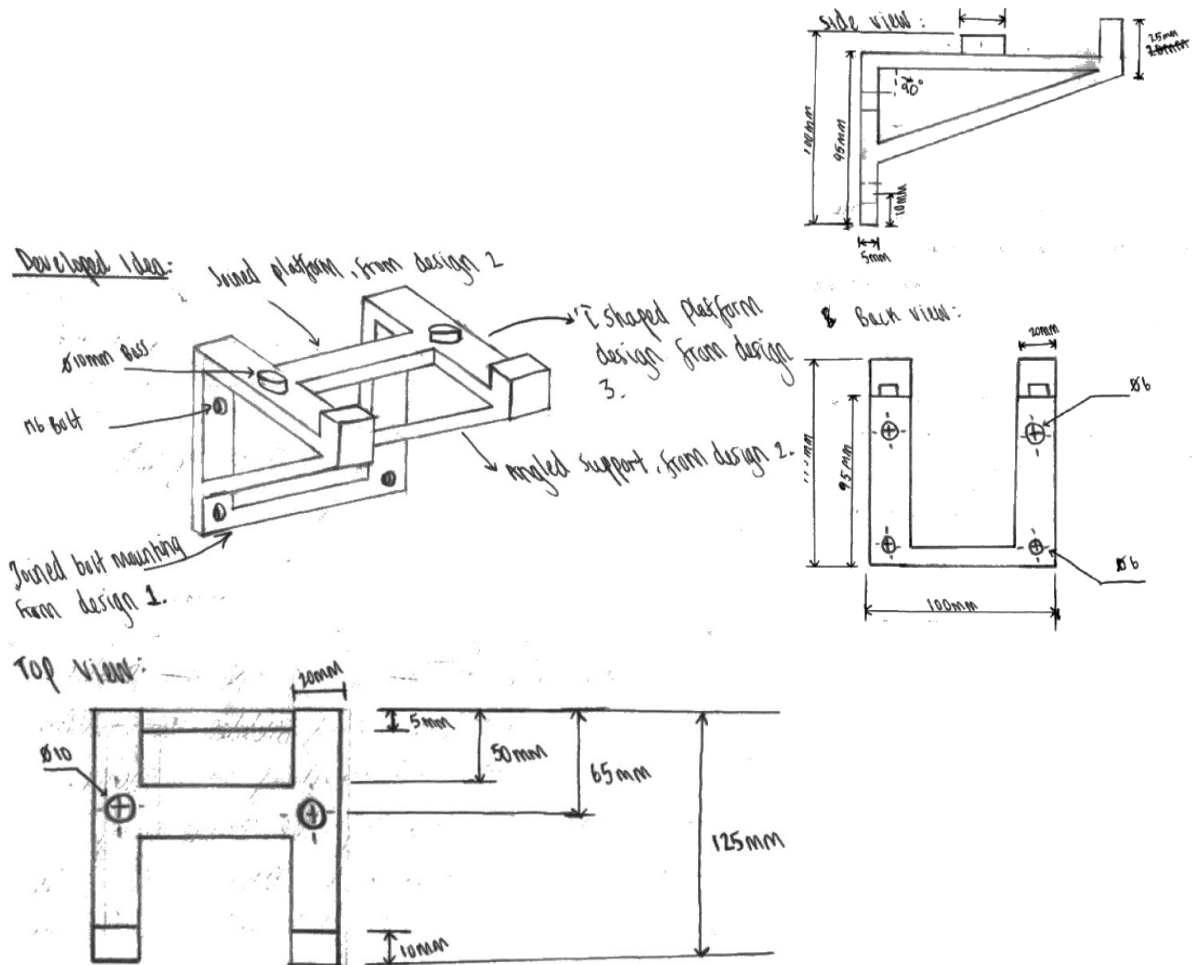
Die casting is a process in which involves the use of heating up ~~non-ferrous~~ an alloy such as zinc.

\* The zinc is heated until is molten, then it is directed to the reusable moulds called die. Once in the mold (die) it is pressed by the clamping unit. The zinc then rapidly cools into its new shape.

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 bracket for a modular induction motor system) 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 bracket design 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 bracket design, but it was self-congratulatory in places and only referenced the 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 bracket design.

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) bracket design, for example 'The bracket design is less likely to move or break now that it is a single, multi-supported bracket for both sides, which solves a lot of problems with the original design. It still isn't the best design though as that would be where the single bracket could be attached to the enclosure as one piece and then positioned into slots in the backing plate when needed. This would mean that the bracket wouldn't be in the way if not being used, as it is big and permanently takes up wall space, but I couldn't do that as the enclosure couldn't be redesigned.'
- The rationale gave good reasons as to why the solution was effective and referenced some of the 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 to monitor/warn users of bracket cracks/excessive vibration or motorised removal of the enclosure.

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 a balanced appraisal of a possible limitation. The appraisal is particular to the solution itself, gives a reason why the specific issue (as stated in the Part B Client brief) has not been addressed and also refers to a feature of the redesign that may help to ameliorate it. This type of response is representative of Band 3 evidence.

In Extract 2, the learner has provided a list of statements that refer to the perceived successes of the new solution; however, the said comments generally just repeat (using different words) some of the text in the Part B Client brief. Specific examples and/or justifications as to why the new bracket design meets the 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 some possible further modifications; it is questionable as to whether they are entirely 'technology-led', but they may be feasible and could help to improve the effectiveness of the solution. As a result, this type of response is representative of Band 2 evidence.

#### Extract 1

However there is a limitation to my completed solution which is that there is nothing to prevent vibrations. I didn't want to use rubber in my design due to the fact it is not ~~the~~ environmentally friendly, although I had added an additional support piece at the front of the bracket which prevents ~~it~~ from the induction motor from falling off the bracket if the boss does develop some wear over 2 years.



### Extract 2

My modified bracket design should will be able to:

- provide sufficient and secure support for the motor
- improve efficiency of materials used
- reduce fatigue and strain on the bottom supports
- reduce wear on the boss and the coating due to vibrations
- increase the overall life cycle of the product

### Extract 3

modifiable e.g. the client wants the induction motor easily accessible so with technology a bracket could be designed to make the bracket release the induction motor while it is being accessed. Technology could also make it on some sort of lift so that workers do not need to use ladders to access the induction motor and it can just come down to them.

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 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 (RQF) are available from:

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