

CAMBRIDGE NATIONALS

Moderators' report

ENGINEERING MANUFACTURE

J832, J842

R110-R112 Summer 2022 series

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Introduction

Our Lead Moderators' reports are produced to offer constructive feedback on centres' assessment of moderated work, based on what has been observed by the moderation team. These reports include a general commentary of accuracy of internal assessment judgements; identify good practice in relation to evidence collation and presentation and comments on the quality of centre assessment decisions against individual Learning Objectives. This report also highlights areas where requirements have been misinterpreted and provides guidance to centre assessors on requirements for accessing higher mark bands. Where appropriate, the report will also signpost to other sources of information that centre assessors will find helpful.

OCR completes moderation of centre-assessed work in order to quality assure the internal assessment judgements made by assessors within a centre. Where OCR cannot confirm the centre's marks, we may adjust them in order to align them to the national standard. Any adjustments to centre marks are detailed on the Moderation Adjustments report, which can be downloaded from Interchange when results are issued. Centres should also refer to their individual centre report provided after moderation has been completed. In combination, these centre-specific documents and this overall report should help to support centres' internal assessment and moderation practice for future series.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our [website](#).

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Unit R110 General overview

From given engineering drawings, candidates were able to plan the manufacture of a pre-production product. Candidates then followed their plans and engineering drawings to manufacture a pre-production product using hand and manual machining processes. Upon completion of the pre-production product candidates reflected on their plans to identify where modifications could be made to it to facilitate an upscale in production to a batch of pre-production products: many candidates did not modify their original plans.

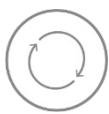
Comments by LO

LO1 – Be able to plan for the making of a pre-production product

Candidates were able to accurately interpret given engineering drawings with sound understanding of standard drawing conventions. It was unfortunate that not all candidates did not interpret both 2D and 3D engineering drawings, as was indicated in the assessment criteria. Many candidates annotated directly onto engineering drawings the relevant details and requirements appropriate to the making of a pre-production product. This was seen as very good practice.

Equipped with information on the pre-production product to be manufactured, candidates produced a production plan. Good quality plans identified an appropriate sequence of tasks, a description of each task, the tools, equipment and materials that would be required for the task, health and safety, and quality control considerations: the addition of time allowed for each task was not always considered. To access the very highest marks plans should identify all specific tooling. For example, drill type and sizes for drilling, exact lathe tools for turning operations and the type and size of milling cutters.

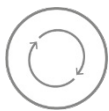
Assessment for learning



2D and 3D drawings:

Refer to the marking criteria for this LO. Interpretation of both 2D and 3D drawings is required to satisfy this fully.

Assessment for learning



Planning:

Candidates could be provided with a blank planning template or table with appropriate headings for them to complete.

LO2 – Be able to use processes, tools and equipment safely to make a pre-production product

A wide range of permitted adaptations were available to centres and candidates for 2022. For example, where workshops facilities were available, the minimum number of manufacturing processes required was relaxed to two different processes to reduce the amount of time needed in a workshop. Where there was limited access to workshop facilities, candidates could carry out a range of activities in the workshop to show their skills. They could also have a professional discussion to explain how they would use different skills to make the final product. Across all entries there was a wide range of acceptable adaptations which demonstrated the application of appropriate working practices when using hand and machine processes. Photographic diaries and written descriptions communicated how tools and equipment were used safely during the making of the pre-production product. Many candidates identified and used appropriate PPE where necessary.

Understanding of safe use of tools and equipment and the application of appropriate working practices can be evidenced using simple risk assessments, and candidate independence and competence can be corroborated by a witness statement.

Candidates are required to include with their portfolio of evidence clear photographic evidence of the finished product, and review the quality of the product. It was acknowledged that this requirement could not always be met due to restrictions imposed and difficulties encountered. However, many candidates were able to review pre-production products against engineering drawing requirements and provide some comments on quality and accuracy: reviews tended to be quite brief.

This LO also provides opportunity for candidates to make synoptic links to learning in R109.

OCR support



Witness statements:

Full guidance on how to use witness statements can be found in Appendix A of [the Specification Handbook](#).

It is important to remember that they cannot be used as a substitute for direct evidence that the candidate can produce. They should only be used to support and corroborate things like independent and safe working, or the quality of a finished product.

Assessment for learning



Synoptic teaching and learning:

Candidates are required for this LO to draw upon skills/knowledge/understanding from other units in the specification and it would be useful if this was made explicit within their responses.

LO3 – Be able to modify a production plan for different scales of production

Candidate responses to this LO were not always in line with the requirements of the LO, and open to misinterpretation. Candidates are required to return to their original plan for making and to make modifications to facilitate an upscale in production to a batch of pre-production products.

There was evidence of quite generic responses to the LO, with descriptions of different scales of production (one-off, batch and mass) without direct modification to the original plan, and often there were generalised references to CNC and automated processes.

Examples of modifications that could be made to the plan include batching operations, running operations in parallel, using standard size stock material, using standard components, using jigs and fixtures, using different QC techniques (e.g., gauges, sampling). Specifying that the component could be made using a CNC machine was not a satisfactory response.

Misconception



Candidates should return to their original plan and provide modifications suitable for scale production. There is no need to provide generic descriptions of different scales of production. It is not the intention of this LO to specify the use of CNC machines.

Unit R111 General overview

Candidates were able to plan for production of components on CNC machines, often utilising a given planning for making template. They then produced Computer Aided Design (CAD) drawings of a product that went on to be produced in batch by Computer Numerical Control (CNC) manufacturing. The set up a CNC machine for manufacturing was not always too well recorded, visually or written. Finally, candidates demonstrated knowledge and understanding of how computer control can be used in the high-volume/mass production of engineered products.

Comments by LO

LO1 – Be able to plan the production of components on Computer Numerical Control (CNC) machines

Planning templates were used by most candidates with relevant headings, which is fine. Occasionally flow charts were used, but they rarely covered all appropriate areas or provided depth to the required information. Planning for set up was rarely written into planning documents, perhaps if a set up stage was identified this could enable candidates to include more detail in their plans, which could be followed through in LO3. Few candidates identified the specific cutting tools that would be used to manufacture using a CNC machine. An acknowledgement of potential health and safety issues is often written into planning for making documents, these could be linked to a risk assessment.

Assessment for learning



Planning

Candidates could be provided with a blank planning template or table with appropriate headings for them to complete.

LO2 – Be able to interpret information from CAD to manufacture components on CNC equipment

Most candidates were able to use Computer Aided Design (CAD) packages to draw components and annotated screenshots of CAD drawings at various states in their development provided excellent evidence. Once manufacturing files had been produced, on-screen simulation demonstrated potential outcomes. Candidates are required to consider relevant factors that could affect the potential outcome such as specific tooling, tool offsets and tool paths, cutting speeds, etc. communication of amendments to settings were not always well communicated by screenshots, explanations, or through a professional discussion as allowed in the permitted changes for 2022. Many able candidates were able to describe the language CNC machines use in detail, e.g., G-codes. Witness statements can be used to corroborate the level of candidate independence and competence when they are interpreting a CNC program.

OCR support



Witness statements:

Full guidance on how to use witness statements can be found in Appendix A of [the Specification Handbook](#).

It is important to remember that they cannot be used as a substitute for direct evidence that the candidate can produce. They should only be used to support and corroborate things like independent and safe working, or the quality of a finished product.

LO3 – Be able to set-up and use Computer Numerical Control (CNC) equipment to manufacture components

In this LO, candidates should demonstrate that they can safely set up and operate a chosen CNC machine. Using annotated photographs or detailed explanation. Many candidates provided risk assessments in recognition of potential health and safety risks. Where access to CNC manufacturing machines was available, annotated photographs often showed how candidates went about setting up a CNC machine however, it was apparent from many photographs that CNC machines were pre-loaded with the cutting tools. As teaching and learning settings return to more normalised environments, candidates could once again be encouraged to select the actual tooling that will be required and fully set up the CNC machine. Witness statements were not always used appropriately: it is candidate-generated evidence that is assessed.

Where candidates had issues of access to CNC manufacturing hardware, the permitted changes for 2022 allowed for centres to group candidates work to provide a comparison between manual and CNC manufactured components. Candidates could use the components made in R110 and R111 or other given components, as the basis for their comparison including the points identified in the Unit Specification (visual, dimensional, cycle time, consistency). This comparison was often not convincingly presented.

OCR support



Witness statements

Full guidance on how to use witness statements can be found in Appendix A of [the Specification Handbook](#).

It is important to remember that they cannot be used as a substitute for direct evidence that the candidate can produce. They should only be used to support and corroborate things like independent and safe working, or the quality of a finished product.

Assessment for learning



Risk assessment

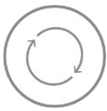
Risk assessment templates can be given to candidates for them to complete.

LO4 – Know about applications of computer controlled processes used to manufacture products

This LO was often well attempted, with candidates demonstrating excellent research skills to investigate a range of different computer-controlled processes. Perhaps analysis of research could lead to detailed examples of where they are used and suggestions for why they are used in particular types of industry.

Computer-controlled processes should relate to the scale of production for which they are most suitable. Often candidates provided generic descriptions of different scales of production without relating these to a process. Examples include rapid prototyping for one-off production, CNC machines for batch production, and robotics for mass production. Please refer to the Unit Specification for examples.

Assessment for learning



Referencing

This LO provides excellent opportunity for candidates to reference the information they have found while researching.

Referencing is important to avoid potential plagiarism, and [further guidance on referencing](#) is available on the OCR website.

Unit R112 General overview

Candidates develop knowledge and understanding of techniques and procedures used to review the quality of engineered products. Candidates review the quality of products using a range of quality control tools and equipment and evaluate the results of quality control inspections. Candidates also develop knowledge and understanding of the principles of lean manufacture and how they can be applied to improving the quality of the manufacturing process.

Comments by LO

LO1 – Understand the importance of quality control

Candidates were able to describe reasons for implementing quality control in production though relevant examples were not always given. It was noted several times that candidates did not respond to the first sub-criterion for this LO. Please refer to the unit specification for details of reasons and procedures. Candidates were able to describe the quality control procedures used in production.

Assessment for learning



Referencing

This LO provides excellent opportunity for candidates to reference the information they have found while researching.

Referencing is important to avoid potential plagiarism, and [further guidance on referencing](#) is available on the OCR website.

LO2 – Be able to assess product quality from inspection and quality control techniques

Candidates were able to describe quality control techniques and inspection checks used stage of production, though on occasion, response were generic lists not linked to any specific inspection process across stages of production. Witness statements were often provided to corroborate the level of candidate independence when they were inspecting a product. Tools and equipment used to inspect products was often limited to measuring equipment such as digital vernier calipers and gauges as allowed in the permitted changes for 2022. As teaching and learning settings return to more normalised environments, candidates could once again be encouraged to use a wider range of relevant quality control tools and equipment and communicate how they use them with annotated photographs.

Candidates did not always identify clear synoptic links between other units in the specification.

OCR support



Witness statements

Full guidance on how to use witness statements can be found in Appendix A of [the Specification Handbook](#).

It is important to remember that they cannot be used as a substitute for direct evidence that the candidate can produce. They should only be used to support and corroborate things like independent and safe working, or the quality of a finished product.

Assessment for learning



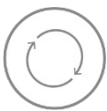
Synoptic teaching and learning

Candidates are required for this LO to draw upon skills/knowledge/understanding from other units in the specification and it would be useful if this was made explicit within their responses.

LO3 – Know how modern technologies can be used in quality control

Candidates researched modern technologies that can be used in quality control and there were some good examples of appropriate technologies however, examples of how these technologies can be applied in quality control in industry was not always as detailed as perhaps it could have been. Please refer to the unit specification for the content that candidates must be taught.

Assessment for learning



Referencing

LO3 and LO4 provide excellent opportunity for candidates to reference the information they have found while researching.

Referencing is important to avoid potential plagiarism, and [further guidance on referencing](#) is available on the OCR website.

LO4 – Know the principles of lean manufacturing

The majority of candidates were able to provide a description of the categories of waste and methods used to reduce waste in lean manufacturing. Each area of TIMWOOD and expounded with a good degree of detail and understanding of the principles of lean manufacturing. For the second criterion of LO4, candidates are required to demonstrate understanding of methods for waste reduction i.e., Design for Manufacturing Assembly (DFMA) and sustainable design. Often, candidates' responses were brief and did not always consider issues identified in the specification content for the LO. Please refer to the unit specification for the content that candidates must be taught.

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