Teacher's guide

Edexcel GCSE in Manufacturing (Double Award)

First award in 2004

October 2002

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Authorised by Peter Goff

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Introduction

This teacher's guide accompanies the Edexcel GCSE specification for Manufacturing (Double Award) and has been designed to help teachers prepare their students for assessment in 2004 and beyond.

This guide should be used in conjunction with the specification. It provides sections to help with planning teaching programmes and managing the assessment requirements.

It is planned to issue a separate publication containing assessed items of student work. This will give further guidance on the application of the mark bands in the assessment grids for each of the internally assessed units, and provide a first indication of the levels of response.

Specification summary

GCSEs in vocational subjects

A range of GCSE (Double Award) specifications in vocational subjects has been introduced to replace and extend the range of Part One GNVQ courses at levels 1 and 2 of the National Framework of Qualifications. They can be taken as two-year courses from September 2002 and one-year courses from September 2003 for first awarding in summer 2004.

Edexcel GCSE in Manufacturing (Double Award)

The Edexcel GCSE in Manufacturing (Double Award) has been designed to provide a broad educational basis for further training, further education or for moving into employment within the manufacturing industry.

Specification structure

The specification consists of three compulsory units, which are equally weighted. Two units are internally assessed through the production of portfolios, and one is externally assessed by a written test. The first external assessment opportunity and first moderation of internal assessment will be in May/June 2004.

Unit content	Assessment
Unit 1: Designing Products for Manufacture Product requirement and constraints, production details and constraints, material details and constraints, developing design ideas, scientific principles, presenting design solutions and modifying design solutions.	**Internal assessment** Produce a product design specification and design solution for a manufactured product from a given customer brief.
Unit 2: Manufactured Products Use a production plan, develop a schedule for manufacture, use and apply quality control techniques, record and respond to quality data, use tools and equipment including CAM safely, team working.	**Internal assessment** Produce a portfolio and a quantity of one product, manufactured as part of a team from a given product specification and production plan. The product must be made from at least two components of different materials.

Unit content	Assessment
Unit 3: Application of Technology How technology has developed design and manufacturing processes, improved the quality of products and customer service and the implications of modern technology on the work force and wider community.	**External assessment** 1½ hour examination. Choice of **one** from the following **six** sectors: • printing and publishing, paper and board • food and drink, biological and chemical • textiles and clothing • engineering fabrication • electrical and electronics, process control, computers, telecommunications • mechanical, automotive. Pre-release information on sector based product will be available to centres in September for the following June examination.

Planning a teaching programme

The programme has been designed to be delivered as a two-year course. As such, when considered within the normal GCSE framework, it would be suitable for delivery over Years 10 and 11. However, it is possible to deliver the qualification as a one-year programme, and as a vocational course would be suitable for Year 12 students.

When planning a programme of learning and assessment, centres will need to consider the availability of resources. This consideration will focus on the availability and expertise of staff, the availability of external resources such as industrial expertise and vocational placements. The availability of resources will, in many cases, direct the most suitable delivery model.

Unit 3 in the Manufacturing programme is identical to that of the Engineering programme. Other similarities exist with Units 1 and 2. Centres could offer both qualifications and co-teach some aspects of the programme. This would be particularly useful if accommodating a team teaching approach. It must be remembered though, that when choosing their options of study, an individual student cannot study both Manufacturing and Engineering since they form a forbidden combination.

The demands within the programme are such that the vocational aspects should be planned into the delivery of the course at every opportunity. Visits to local or national manufacturing companies should be considered a priority when planning the course. The timing of these visits is a crucial aspect of planning. It would be appropriate for the course team to explore the content of each unit in order to clearly identify resource requirements and plan visits that meet any shortfalls. Should suitable visits or work experience opportunities not be available or practical, the course team should organise guest speakers to provide the relevant input into the programme. Most Local Education Authorities will have a person responsible for supporting work-based learning and work-based contact. The Engineering and Manufacturing Training Authority (EMTA) and the Employers Federation are also helpful in supporting setting the GCSE in a vocational context. Centres are encouraged to draw on these organisations for support. Links with local colleges may also prove beneficial.

It is important that the course has an induction programme and could include information such as:

- an outline of the course
- an overview of each unit
- teaching and learning strategies
- requirements of the students
- assessment procedures
- examples of expected outcomes/exemplar material.

During the planning stage it is important that the course team considers the assessment requirements of the programme. Unit 3 is subject to external assessment and students should be taught examination techniques to enable them to achieve maximum success. Centres should prepare candidates by using the exemplar materials and previous examination papers, as they become available.

By studying the content of each unit and identifying the availability of resources, the course team should be able to decide on those strategies best suited to the delivery of the programme. Manufacturing is a complex area and the Units have strong links. Unit 1 carries design skills that can only be fully exploited with an understanding of how products are manufactured, which is also a requirement of Unit 2. The application of technology spans both these Units and is

delivered and assessed in Unit 3. Students are encouraged to use manufacturers and sector specific web-sites during their study and centres need to consider this requirement when planning access to resources.

Whichever method of delivery is chosen, an important element in the planning of this programme is to ensure that students have the opportunity to frequently carry out practical activities. These activities may improve the motivation of students. They will certainly offer an opportunity to practice skills, and could provide essential information for use in later assessment. The activities can and, before being subject to assessment. It should be noted that students are not required to make the product designed in Unit 1.

Centres have the option of delivering the Manufacturing GCSE, through the main study of any one of the following sectors:

- printing and publishing, paper and board
- textiles technology
- food and drink, biological and chemical
- engineering fabrication.

It is possible that centres may wish to focus on different manufacturing sectors in the coverage of each unit. For example Unit 1 may focus on a food theme, Unit 2 a textiles theme and Unit 3 could centre on the investigation of control technology. This may have the disadvantage of covering a wide range of processes, techniques and technology, but may suit timetabling constraints where teachers with different areas of expertise are to deliver different units.

Timetabling needs to ensure that staff can accommodate the requirement to set the programme in a vocational setting. The programme demands suitable blocks of time, particularly when considering the need for industrial visits. Whole morning or afternoon sessions are advisable. This will enable the team to arrange visits, research etc without disrupting the normal timetable. Time is also required for tutorial support including assessment feedback.

If centres are delivering Design and Technology at Key Stage 4, it may be worth considering how aspects of its delivery could support the learning required for GCSE Manufacturing.

Models of delivery

When planning a programme of learning and assessment, centres may find it useful to consider the effects of differing delivery models. The following tables provide examples of possible delivery models. These are not intended to be exhaustive or prescriptive, but may provide a useful start to programme planning.

Model 1

<table>
<tr><td></td><td colspan="3">Autumn Term</td><td colspan="2">Spring Term</td><td colspan="2">Summer Term</td></tr>
<tr><td rowspan="3">Year 10</td><td rowspan="3">Induction</td><td>Unit1</td><td rowspan="2">Review</td><td colspan="3">Unit 1</td><td rowspan="2">Review</td></tr>
<tr><td>Unit 2</td><td colspan="3">Unit 2</td></tr>
<tr><td colspan="6">Unit 3</td></tr>
<tr><td rowspan="3">Year 11</td><td colspan="3">Unit 1</td><td colspan="3">Complete assignment for Unit 1
and provide formative assessment</td><td rowspan="2">Summative Assessment</td><td rowspan="2">Moderation</td></tr>
<tr><td colspan="3">Unit 2</td><td colspan="3">Complete assignment for Unit 2
and provide formative assessment</td></tr>
<tr><td colspan="3">Investigate aspects of technology in preparation for Unit 3</td><td colspan="3">Completion of assignments for Units 1 and 2
OR
Prepare for Unit 3 – external test</td><td colspan="2">Unit 3 – external test</td></tr>
</table>

Characteristics:

- it provides a delivery model suitable for a team possessing different vocational skills
- Units 1, 2 and 3 may each have a different vocational focus
- it provides the opportunity to link skills development across the units.

Model 2

<table>
<tr><td></td><td colspan="3">Autumn Term</td><td colspan="2">Spring Term</td><td colspan="2">Summer Term</td></tr>
<tr><td rowspan="3">Year 10</td><td rowspan="3">Induction</td><td>Unit 2</td><td>Review</td><td colspan="3">Complete assignment for Unit 2
and provide formative assessment</td><td>Summative Assessment</td></tr>
<tr><td colspan="6">Unit 3</td></tr>
<tr><td rowspan="3">Year 11</td><td colspan="3">Unit 1</td><td colspan="3">Complete assignment for Unit 1
and provide formative assessment</td><td>Summative Assessment</td><td>Moderation</td></tr>
<tr><td colspan="3">Investigate aspects of technology
in preparation for Unit 3</td><td colspan="3">Completion of assignments for Units 1 and 2
OR
Prepare for Unit 3 – external test</td><td colspan="2">Unit 3 – external test</td></tr>
</table>

Characteristics:

- it provides a delivery model suitable for a smaller team possessing different vocational skills
- Units 1, 2 and 3 may each have a different vocational focus
- it provides the opportunity to link skills development across units.

Students are introduced to manufacturing skills at an early stage in the programme.

Model 3

<table>
<tr><td></td><td colspan="2">Autumn Term</td><td>Spring Term</td><td colspan="3">Summer Term</td></tr>
<tr><td rowspan="2">Year 10</td><td rowspan="2">Induction</td><td>Unit 2</td><td>Unit 2</td><td>Complete assignment for Unit 2 and provide formative assessment</td><td>Summative Assessment</td><td>Moderation of Unit 2</td></tr>
<tr><td colspan="5">Unit 3</td></tr>
<tr><td rowspan="2">Year 11</td><td colspan="2" rowspan="2">Unit 1</td><td rowspan="2">Complete assignment for Unit 1 and provide formative assessment</td><td>Summative Assessment</td><td>Moderation</td></tr>
<tr><td colspan="2">Unit 3 – external test</td></tr>
</table>

Characteristics:

- it allows moderation feedback at the end of the first year
- it provides a delivery model suitable for a smaller team possessing different vocational skills
- Units 1, 2 and 3 may each have a different vocational focus
- it provides the opportunity to link skills development across the units
- students are introduced to the manufacturing skills at an early stage in the programme.

Model 4

<table>
<tr><td colspan="3">Autumn Term</td><td>Spring Term</td><td colspan="2">Summer Term</td></tr>
<tr><td rowspan="3">Induction</td><td>Unit1</td><td rowspan="2">Review</td><td>Complete assignment for Unit 1 and provide formative assessment</td><td rowspan="2">Summative assessment</td><td rowspan="2">Moderation</td></tr>
<tr><td>Unit 2</td><td>Complete assignment for Unit 2 and provide formative assessment</td></tr>
<tr><td colspan="3">Unit 3</td><td>Unit 3 – external test</td></tr>
</table>

Characteristics:

- this model may be suitable for a one-year approach.
- it would only be possible for programmes commencing in September 2003 and subsequent years as the first test opportunity will be in June 2004.

Model 5

Autumn Term			Spring Term		Summer Term	
Induction	Unit 2 Complete assignment for Unit 2 and Provide formative assessment	Summative assessment	Unit 1 Complete assignment for Unit 1 and provide formative assessment	Summative assessment	Unit 3	Moderation and Unit 3 – external test

Characteristics:

- this model may be suitable for a one-year approach
- it would only be possible for programmes commencing in September 2003 and subsequent years as the first test opportunity will be in June 2004
- it provides an opportunity to complete individual units before progressing to the next unit
- it also provides the opportunity to use the outcomes of one unit in subsequent units.

When centres are considering programme construction, they need to be mindful of the effects that certain units will have on subsequent units. With this in mind, it may be useful to audit all units in order to maximise learner achievement.

Centres will also need to give consideration to the positioning of the external assessment instrument for Unit 3.

Developing assignments

When designing assignments, course teams should ensure that the activities proposed generate evidence, which meets the requirements of the assessment grid. The assessment grid is therefore an appropriate document to consider when planning and developing suitable activities and assignments for students. Each mark band will differentiate the levels of performance required to be built into the assignments.

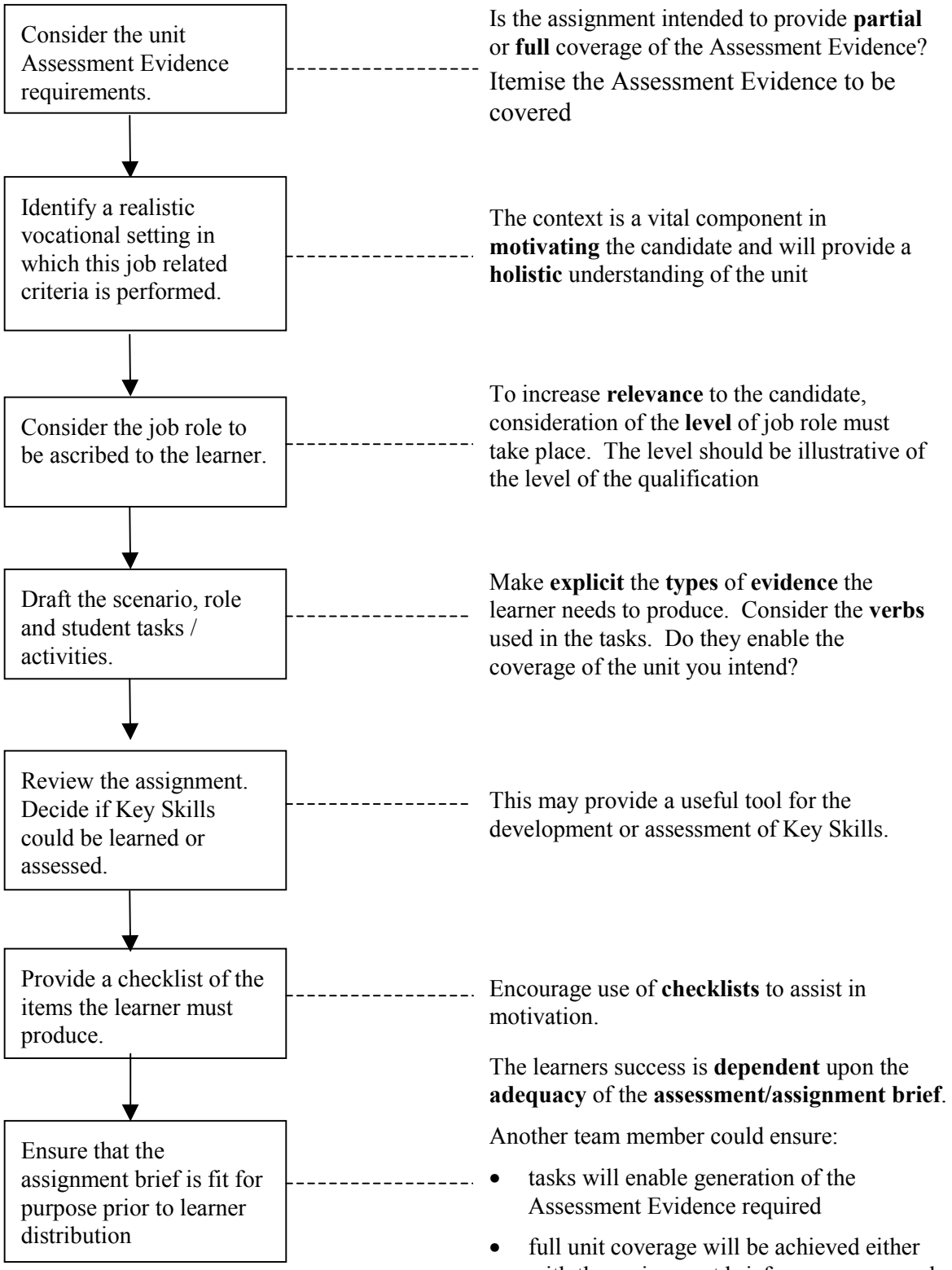
The design of an assignment should allow students to achieve at different levels. Students will require support and guidance in order to make good progress across the grade boundaries and this will be characterised by:

- increasing breadth and depth of understanding
- increasing coherence, evaluation and analysis
- increasing independence and originality.

Whilst an overall assignment brief may exist, it should be broken down into small tasks that require short spans of activity. This approach should allow access to the assignment for those students performing at level 1. GCSE in Manufacturing does not readily lend itself to a design and make project, since the need to be able to manufacture the designed artefact may provide undesirable restraints, particularly to higher achievers, although motivation may be higher. A design and make type project could be used as the outcome from Unit 1. However, the centre must be prepared to provide a product specification and a production plan of sufficient detail. This will enable full coverage of the evidence requirements for Unit 2. If this approach is contemplated the centre must make sure, through careful guidance and support at the initial client brief and design stages, that the final design and product is suitable for planning and making in Unit 2. It should be noted that the student should be provided with a suitable production plan, in order to achieve many of the outcomes of Units 2.

The assignment brief should also provide opportunities for those performing at the higher levels and should allow them to evidence and demonstrate their level of performance, as indicated at mark band 3 of the assessment grid.

The following represents a methodology that could be followed to develop an appropriate assignment and learning activity.


Consider the unit Assessment Evidence requirements.
Is the assignment intended to provide **partial** or **full** coverage of the Assessment Evidence?
Itemise the Assessment Evidence to be covered
Identify a realistic vocational setting in which this job related criteria is performed.
The context is a vital component in **motivating** the candidate and will provide a **holistic** understanding of the unit
Consider the job role to be ascribed to the learner.
To increase **relevance** to the candidate, consideration of the **level** of job role must take place. The level should be illustrative of the level of the qualification
Draft the scenario, role and student tasks / activities.
Make **explicit** the **types** of **evidence** the learner needs to produce. Consider the **verbs** used in the tasks. Do they enable the coverage of the unit you intend?
Review the assignment. Decide if Key Skills could be learned or assessed.
This may provide a useful tool for the development or assessment of Key Skills.
Provide a checklist of the items the learner must produce.
Encourage use of **checklists** to assist in motivation.
Ensure that the assignment brief is fit for purpose prior to learner distribution
The learners success is **dependent** upon the **adequacy** of the **assessment/assignment brief**.
Another team member could ensure:
• tasks will enable generation of the Assessment Evidence required
• full unit coverage will be achieved either with the assignment brief or across several briefs
• learners will know what they have to produce and why
• language used in the brief is suitable for the level of candidates
• the brief is motivating and interesting to learners

By identifying the centres strengths and weaknesses in terms of utilising the resources required to meet the needs of the programme, the course team should be able to develop assignments based around the support and partnership activities required by the vocational nature of the programme.

If teamwork is used in any of the assignments, the course team should ensure the individual roles, responsibilities and achievements of students are identified and recorded.

Assignments should be developed within the sector specific framework, to meet the requirements of the sector's strengths and resources.

These sectors are:

- printing and publishing, paper and board
- textiles and clothing
- food drink, biological and chemical
- engineering fabrication.

Unit 1: Designing Products for Manufacture

Introduction

This unit allows the students to gain an understanding of the overall design process that brings a product to the market place, using the criteria laid down in a clients' design brief.

Students will analyse clients' design brief for a product and use this analysis to produce a product design specification (list of requirements and limitations). This product design specification will include production details, constraints and quality standards that consider the following:

- how the product is to be made
- who will make the product
- what materials will be used
- health and safety issues
- relevant quality standards.

Students will consider the quality standards specified by the client, and how these can be implemented into their designs. They will be encouraged to produce a number of design proposals using various techniques. Each design solution must contain information about the following:

- **production** – the most suitable process, tools, equipment and machinery
- **materials** – their size, properties, characteristics and suitability for manufacturing processes
- **cost** – of materials, resources and production processes and estimated cost of each item
- **market** – type and size
- **quality standards** – for finish, tolerances, performance and quality of material.

Students will evaluate each proposal to choose a final design solution that best meets the clients' requirements.

Final design proposals will be presented to the client using the most effective techniques. This presentation is the student's opportunity to explain and 'sell' their proposal to the client and must show how the design solution meets the client's design brief.

The presentation should include:

- the key features of the solution including information about production and materials
- how the client design brief has been met
- how the design conforms to required quality standards
- details of research carried out to achieve the design proposal.

Students will also respond to client feedback by modifying their design and manufacturing proposals accordingly.

This unit is about designing products for manufacture. Students will learn about the following aspects of the design process:

- product requirements and constraints

- production details and constraints
- material details and constraints
- developing design ideas
- scientific principles
- presenting design solutions
- modifying design solutions.

Unit overview

Background

The aim of this unit is to give students an understanding of the knowledge, techniques and technical vocabulary used by manufacturers when designing products.

Summary of learning outcomes

This unit is assessed through the student's portfolio. The unit grade will be based on the portfolio grade, within the range U, G to A, A*. The higher grades are dependent upon the students achieving the high mark band criteria for the portfolio listed in the Assessment Evidence grid in the unit specification. The higher achievers will show increasing depth and breadth of knowledge, skills and understanding, increasing coherence, evaluation and analysis and increasing independence, innovation and originality.

The students will be required to provide evidence that matches the Assessment Evidence grid for this unit. The unit specification stipulates how the evidence of this practical unit is to be produced. A Product Design Specification and Design Solution need to be produced. The students will produce work in response to learning actives described in the later schedule, covered in the *What you need to learn* section of the unit. Much of this work, although marked, could form part of the student portfolio of evidence, if it is needed to provide proof of assessment evidence coverage.

The learning from this unit will give students opportunities to:

- develop a range of ideas and final a design solution by analysing a client brief
- make a presentation to the client using suitable presentation techniques
- modify the design proposal as a result of client feedback.

To achieve a grade F, students will provide evidence to show:

- a basic analysis of the client brief, identification of basic client needs, the development of some basic design ideas, outline details of a final design solution describing basic details of the design and material constraints, and limited testing of ideas
- a basic understanding of production requirements and quality standards in the design specification
- presentation of the final design solution, using a limited range of communication techniques
- limited response to client feedback when identifying relevant modifications to the design proposal.

To achieve a grade C, students will also show:

- a more detailed analysis of the client brief, identifying the main client needs, the development of alternative design ideas, more detailed final design solutions which describe

some of the product design and material constraints, and a broader range of testing techniques

- a more detailed understanding of some of the production requirements and quality standards in the design specification
- a more detailed presentation of the final solution, using a range of communication techniques
- evaluation of client feedback and communication of relevant modifications to the design proposal.

To achieve a grade A, students will also show:

- an analysis of the client brief, explaining the main client needs, providing justification for alternative, imaginative design ideas, a final design solution that describes the main details of the product design and material constraints, and objective testing to justify the final design solution
- a more detailed understanding of the main details of the production requirements and quality standards in the design specification
- a more detailed presentation of the final solution, using an appropriate range of communication techniques
- an objective evaluation of client feedback and a detailed explanation of the relevant modifications to the design proposal.

Links to other units

There are links to Unit 2: Manufactured Products, where the student will be expected to recognise and use production processes, health, safety and hygiene issues and apply quality and production control techniques during the manufacture of a quantity of products as part of a team. It may be possible to identify the design of a product that is suitable for manufacture in Unit 2. However, the teacher should consider that linking these two units would produce a long 'design and make' task that may well prove too long for some students, but may improve the motivation of others. The use of a 'design and make' project would also require the teacher to provide further details, such as a suitable product specification and production plan, at the appropriate time since some students may not be capable of providing this information in sufficient detail.

This unit also builds on the experiences and prior learning from design and technology work. It also provides some of the knowledge, skills and understanding for several National Vocational Qualification units in Performing Manufacturing Operations (PMO) NVQ level 1.

The wider curriculum

Delivery of this unit can also contribute to the students' understanding of moral, ethical, social and cultural issues, health and safety considerations and European initiatives, consistent with relevant international agreements in the following manner:

- **social**: when considering client's requirements for intended markets/customer base and representing varying sectors of society and preferences for styling aesthetics
- **health and safety**: when considering design in relation to the choice and use of suitable materials, components and particularly processes
- **European initiatives**: when considering the application of production methods and materials in design, standards and conventions.

Overview of learning and assessment strategies

Teaching and learning strategies

Centres should use a wide range of learning methods in order to achieve the learning outcome of this unit. These could include:

- studying current market products and production practices, via visits, speakers' etc
- tutor lead descriptions, discussions and explanations
- practical investigations of production processes
- student directed research activities
- use of case study material and videos
- use of mathematical and scientific techniques and principles.

The teaching and learning activities should draw on material based in industry, wherever possible. This will help students develop vocationally focused, transferable skills.

Although this unit does not contain a mandatory requirement for the assessment of mathematical and scientific techniques and skills, these need to be applied in a variety of ways and will need to be embedded into the delivery and learning of the whole programme. Manufacturers need to be able to use mathematical techniques and skills and scientific principles.

Students should be actively involved in their learning. They should be encouraged to identify case studies, and apply the sector standard designing methods to their own design briefs. Group work is encouraged. However, the work presented for evidence in portfolios must be the student's own work. Discussion and analysis is standard industrial practice and should be encouraged.

The centre should, if possible, develop a range of different client briefs involving a simple product for the students to use. Alternatively, the brief could be more demanding, with a number of students working together with a view to designing separate parts for a complex product. If this approach is taken, it is important to ensure that roles and responsibilities are clearly identified.

Students will need to be provided with the opportunity to explore and analyse different presentation techniques in order to identify strengths and weaknesses. They will also need to practice these skills and techniques before assessment.

The centre will need to provide opportunities for students to present their final design solutions to a client. This client may be an industrial representative or some other person taking on a role-play part. This client should be capable of providing constructive and industrially relevant comment about the suitability of the design solution, in order to provide the student with the opportunity to comment on any appropriate modifications to the design solution.

Students wishing to attain grades around the grade C boundary will need to show a variety of approaches, with few significant omissions in their design solution. The student is able to understand and use more information to make appropriate design choices with little or no help. There is a much clearer awareness of what the client wants, which leads to a more realistic design specification and design solution, recognising production requirements and quality standards. Any evaluation such as that of the strengths and weaknesses of different design solutions is appropriate, leading from a logical and well structured analysis of the clients' brief and an effective identification of key features. The method of presenting the final design

solution is independently chosen, accurate and is sufficient to mainly meet the clients' requirements.

The development of design ideas will come from the use of a range of techniques. It is expected that no help will be given in the research and analysis of information and data.

There will be a range of both ICT and manual techniques to test ideas against the design criteria.

The presentation will explain:

- the key features of the solution
- information about production and materials constraints
- how the client design brief was met
- how the design will conform to quality standards
- details of research
- students will demonstrate evaluation of client feedback and produce modified design proposals as a result of this feedback.

Students wishing to attain grades around the grade A boundary will need to show approaches that are well considered, complete and detailed. The student is able to evaluate information and make logical design choices. There is a clear understanding of what the client wants, which leads to a product design specification and design solution that is justified and accurate. Any evaluation such as that of the strengths and weaknesses of different design solutions is carried out in a confident way and leads from a balanced analysis of the client brief and an effective identification of key features. The method of presenting the final design solution is effectively chosen, accurate and is sufficient to meet the clients' requirements. It is explained in a confident manner.

The development of design ideas will come from use of a range of techniques and there is intelligent use of research and analysis of information and data.

The student will use an appropriate range of both ICT and manual techniques to test ideas against the design criteria.

The presentation will explain:

- the key features of the solution
- information about production and material constraints
- how the client design brief was met
- how the design will conform to quality standards
- details of research.

Students will demonstrate objective evaluation of client feedback and produce explanations of relevant modifications to the design proposals as a result of this feedback.

Assessment strategies

Learning should be supported by an assessment programme. Opportunities should be available for peer and self-assessment in order to develop students' skills in being responsible for their own learning and development. Although this is not a mandatory requirement within the programme or unit, it is good practice to develop candidates' skills in these areas.

Assessment can consist of a combination of formative and summative assessments, depending on the method of delivery.

The assessment grid for this unit indicates the different levels of performances (1 to 3) expected from students. Each level shows descriptors that are attached or linked to the Assessment Objectives (AO) in the specification for the award.

These objectives cover:

- recalling and applying knowledge, skills and understanding
- planning and carrying out investigations and tasks in which they analyse vocational issues and problems
- gathering, recording and analysing relevant information, data and other forms of evidence
- evaluating evidence, making reasoned judgements and presenting conclusions.

In awarding the higher grades, the teacher should ensure that students have taken opportunities to work in an independent way, producing comprehensive work in a confident manner.

The formative assessment in the suggested teaching schedule would occur while the students are working through the initial stages covering the *What you need to learn* section of the specification. It may also occur during the making of the product, with the teacher monitoring the students log. The summative assessment will match the Assessment Evidence grid to the student's log.

As this unit is internally assessed, the assessment for this unit, although treated holistically, is in six parts:

- the development of a design specification
- the development of design ideas
- testing against design criteria
- the final design solution
- selection of communication techniques and presentation of the final solution
- response to client feedback and identification of appropriate modifications to design proposals.

Suggested delivery/activity schedule

The suggested delivery/activity schedule indicates to the deliverer the order in which to teach the topics, learning activities and resources associated with Unit 1. The teacher may wish to use or adapt this schedule for use with this unit. The following schedule is for centres wishing to deliver this as a stand-alone unit.

Activity number	Title	Learning/assessment activity	Resources
1	What are the client needs?	Tutor input – description and examples. Student activity	Specifications. Textbooks. Examples of design briefs. Incomplete description statements.
2	Analysis of design briefs	Tutor outlines examples Student group activity	Tutor example Examples of design briefs
3	Choosing a design brief	Tutor input on design briefs Students make choice	Examples of design briefs.
4	Identify client needs	Student activity Group discussion	Specification.
5	Research client needs	Tutor describes 'How to' Student activity – research	Textbooks. Technical information Specification
6	The design specification	Tutor input Student activity Group discussion Students develop their own specification	Examples of briefs and design specifications
7	Cost calculations	Tutor activity Student response	Examples of cost calculations
8	Production constraints	Tutor activity. Student research activity. Students produce conclusions. Reference to unit 2 Possible student practice of manufacturing processes to evaluate implications Setting the scene	Textbooks. Examples of production constraints Specifications. Manufacturing scenario
9	Initial designs	Tutor activity Student response	Textbooks Tutor support Drawing equipment
10	Choosing the design Evaluating strengths and weaknesses	Tutor description Student activity	Tutor support Textbooks
11	Use of CAD/ICT	Tutor-led practical activity	CAD/ICT Practical activities
12	Presentation techniques	Tutor input – outline of presentation techniques Students plan presentations	Textbooks Presentation resources OHP's etc

Suggested learning activities

These provide examples of activities that may be used by the tutor to cover the *What you need to learn* part of the unit. They are designed to give the student the opportunity to practice specific areas of knowledge, understanding and practical skills.

There should be opportunities for students to practice and demonstrate the skills and knowledge required for achieving higher grades.

Activity 1

Identifying the client's needs

The tutor describes client needs ie

- function – where and what the product will be used for
- performance – how well the product has to perform
- intended markets – who might use the product, competition with other similar products, clients' own customer base
- quantity – how many are required
- styling/aesthetic appearance – the products appearance and appeal
- quality standards – sector and/or client quality standards
- styling aesthetics – the appearance and appeal of the product
- cost – including design, production and material costs
- scale of production – quantity required, use of mass or batch production.

A suitable student response would involve students completing sentences/missing words etc.

Activity 2

Analysis of the design brief

The tutor discusses examples of design briefs. Working in small groups/pairs, the students choose a favourite product and write a design brief for that product, perhaps using the 'key features' headings from the unit specification.

Activity 3

Selecting a design brief

The tutor discusses the design briefs, helping the students choose the most suitable one. It is best if the brief is based on a topic that the student has shown an interest in. However, it is appropriate that the brief chosen allows the student to produce a design solution that is appropriate for this level.

Activity 4

Identifying the client's needs

Following a general discussion regarding the client needs for the chosen design brief, the students' list the client needs under the headings previously used in activity 1.

Activity 5

Researching the client's needs

The tutor gives examples of product design specifications and discusses various research techniques. The students consider their own research and prepare a list of requirements and limitations (their own product design specification).

Activity 6

Developing a design specification

Following a general discussion regarding the design brief and how it develops into a design specification, the students discuss and discover the relationship between the brief and the specification. Examples are required for this. Focussing back on the example material, students develop their own design specification.

Activity 7

Calculating costs

The tutor discusses and gives examples of cost calculations covering, labour, materials, overheads and quantities required. The students then estimate costing for their own products. These estimates may be based on learning from practical activities to determine times for manufacturing processes.

Activity 8

Production constraints

The tutor describes and gives examples of production constraints and these should include:

- labour – is there enough staff? Do they have the right skills and/or training?
- materials and components – what are the properties and features of materials and components that make them suitable for certain processes? Can they be bought in?
- available technology – what is the most appropriate technology for a particular process and material?
- health, safety and hygiene – when and where is it important in the production process?
- quality standards required by the client and/or the sector – is a special material quality required?

The tutor then 'sets the scene' by providing the students with information about workshop etc. Discussion could include what the students are doing in other units.

The students need to include this information in their design specification.

Activity 9

Developing initial design proposals

Tutor input regarding initial design proposal techniques, sketching, annotation, basic modelling and identifying changes/modifications made. These techniques should include:

- research and analysis of information and data – existing products, materials and manufacturing processes and market need
- discussing ideas with others
- freehand sketching of ideas
- modelling and testing ideas
- developing and testing samples and prototypes.

Students need to develop some initial ideas through to at least two design proposals, including all relevant information (production, materials, cost, market and quality standards). Practice freehand sketching and perspective drawing. Simple block, flow, schematic and circuit diagrams.

Activity 10

Selecting a design proposal

The tutor describes methods of applying product evaluation criteria to the students design proposals. One method may be the use of a score chart, where students award points depending on how well each proposal meets the design specification. The students can then choose one proposal to become the design solution.

Activity 11

Application of CAD/ICT

A teacher led activity to allow students to gain sufficient skills to produce part of their design solution using this technology. It is appropriate to include this learning opportunity at this stage of the course, as students will be motivated to do preceding work if they know that they will be allowed access to CAD upon completion of their work and activities. Where possible, designs should be linked to computer aided manufacture (CAM). There may be restrictions within the centre due to lack of some workshop resources. Links with local further education engineering departments may prove useful for training and practical work. This may be a particularly helpful way of introducing the link between computer-aided design (CAD) and computer aided manufacture (CAM).

Activity 12

Developing presentation techniques

The tutor outlines various examples of presentation techniques, highlighting the need to understand audience requirements in terms of understanding and interest.

Students need to produce a plan for the presentation of their design solution using their preferred technique, addressing the key features of the solution, including information on production constraints, and how their solution meets the clients' design brief.

Additional resources

Books

Basic Manufacturing
Roger Timings, Gillian Whitehouse et al.
19th December 2000
ISBN: 0750648805

Intermediate GNVQ Manufacturing
Jim Kelly
1st October 2000
ISBN 1861527136

Collins CDT GCSE: Design and Communication
M Finney and K Crampion
12th January 1998
ISBN 0003220346

Nuffield Design and Technology Project
Longman
1st May 1996
ISBN: 0582234697

TEP GNVQ Manufacturing Handbooks 14-16 and 16+

Edexcel INSET

There is a full programme of Inset planned to support this and other GNVQ Manufacturing courses. These are identified in the Edexcel INSET guide for Technology. There is also a planned series of Networks throughout the country.

Unit 2: Manufactured Products

Introduction

This unit attempts to simulate the work done by a manufacturing team. The product produced should use a limited number of manufacturing processes, however it must have a minimum requirement of at least two components or different materials. The team will be expected to manufacture a quantity of one product, using a product specification and a suitable production plan. These are important aspects of this unit. The application of quality control and health and safety also form an important aspect of this unit.

This is a practical unit in which the student will interpret a given production plan in order to develop a suitable schedule for the manufacture of the required quantity of a product. The unit will develop an understanding of manufacturing procedures and help students to

- use production plans
- develop a schedule for manufacture
- use and apply quality control techniques
- record and respond to quality data
- use tools, equipment and machinery safely
- work as an effective member of a team.

Unit overview

Background

The aim of the unit is to give students an understanding of the knowledge, techniques and procedures used by manufacturers when planning and manufacturing products.

Summary of learning outcomes

This unit is assessed through the students' portfolio. The unit grade will be based on the portfolio grade within the range U, G to A, A*. The higher grades are dependent upon the students achieving the high mark band criteria for the portfolio listed in the Assessment Evidence grid in the unit specification. The higher achievers will show increasing depth and breadth of knowledge, skills and understanding, increasing coherence, evaluation and analysis and increasing independence, innovation and originality.

The students will be required to provide evidence that matches the Assessment Evidence grid for this unit. The unit specification does not stipulate how the evidence of this practical unit is to be produced. However, the most suitable method could be a student log/diary of their activities during the preparation and making of their product. Students should be encouraged to record their performance with the aid of annotated photographs and also witness statements. Students will produce work in response to the learning activities described in the later schedule, which cover the *What you need to learn* sections of the unit. Much of this work, although marked, could form part of the student portfolio of evidence, if it is needed to provide proof of assessment evidence coverage.

The student log needs to allow students the opportunity to register all the work that they were personally involved with. This need not be completed at the end of each lesson. A more useful time for recording coverage could be at the end of each stage.

The learning from this unit will provide students with opportunities to:

- develop a schedule for manufacture from a production plan
- use and apply quality control techniques
- prepare materials and components, and equipment and machinery safely
- take an active part, as a team member, in the safe manufacture of a product to meet client requirements and quality standards
- understand what makes an effective team
- evaluate a production plan and schedule for manufacture and suggest possible improvements.

To achieve a grade F, students will provide evidence to show:

- use of some relevant information in the production plan to produce part of a schedule for manufacture
- limited use of quality control techniques to monitor production and identify problems
- prepare and use safely, with guidance, materials and components according to relevant production criteria
- prepare and use safely, with guidance, tools, equipment and machinery with some accuracy to make the product
- manufacture the product, meeting some of the clients' requirements and conforming to some of the required quality standards
- some understanding of what makes an effective team and meeting some of the individual targets
- suggested some modifications, some of which are relevant and lead to the improvement of some aspects of the production plan and schedule for manufacture in response to quality data.

To achieve a grade C, students will also show:

- use of the main relevant information in the production plan, to produce a schedule for manufacture in some detail
- use of a range of quality control techniques to monitor production and describe causes of problems
- prepare and use safely, with limited guidance, materials and components according to the main production criteria
- prepare and use safely, with limited guidance, tools, equipment and machinery with accuracy and some skill to make the product
- manufacture of the product, meeting the main client requirements and conforming to the main required quality standards
- a description of what makes an effective team and meeting some individual targets. Suggest some modifications, most of which are relevant and lead to the improvement of several aspects of the production plan and schedule for manufacture in response to quality data.

To achieve a grade A, students will also show:

- confident use of the main information in the production plan to produce a detailed schedule for manufacture
- use of objective quality control techniques to monitor production and explain how to prevent the occurrence of problems
- preparation and safe use of materials and components according to all of the relevant production criteria, achieving optimum use and working independently
- independently, precisely and consistently prepare and use safely, tools, equipment and machinery with accuracy and skill to make the product
- manufacture the product, to effectively meet the main client requirements and to consistently conform to the main required quality standards
- an explanation of what makes an effective team, and successful in meeting individual targets
- modifications, all of which are relevant and lead to the improvement of significant aspects of the production plan and schedule for manufacture in response to quality data.

Links to other units

There are links to Unit 1: Designing Products for Manufacture. It may be possible to identify the design of a product that is suitable for manufacture in this unit. However the teacher should consider that linking these two units would produce a long 'design and make' task that may prove too long for some students, but may improve the motivation of others. The use of a 'design and make' project would also require the teacher to provide further details, such as suitable product specification and production plan, at the appropriate time since some students may not be capable of providing this information in sufficient detail.

This unit also builds on the experiences and prior learning from design and technology work. It also provides some of the knowledge, skills and understanding for several National Vocational Qualification units in Performing Manufacturing Operations (PMO) NVQ level 1.

The wider curriculum

Delivery of this unit can also contribute to the students' understanding of moral, ethical, social and cultural issues, health and safety considerations and European initiatives consistent with relevant international agreements in the following manner:

- **social**: when considering how a product is to be made and when considering health and safety legislation within a production plan and ensuring safety in the work place
- **health and safety**: when using materials, components and particularly processes
- **European initiatives**: when considering quality standards and health and safety legislation affecting the use of materials and processes.

Overview of learning and assessment strategies

Teaching and learning strategies

Centres should use a wide range of learning methods in order to achieve the learning outcomes of this unit. These include:

- question and answer sessions
- practical demonstrations
- discussions
- role-play (simulated production line)
- practical use of workshop equipment
- practical activities
- research activities
- use of case study material and videos
- use of mathematical and scientific techniques and principals
- visits etc.

The teaching and learning activities should draw on material based in industry wherever possible. This will help students develop vocationally focused, transferable skills.

Although this unit does not contain a mandatory requirement for the assessment of mathematical and scientific techniques and skills, these need to be applied in a variety of ways and will need to be embedded into the delivery and learning of the whole programme. Manufacturers need to be able to use mathematical techniques and skills and scientific principles.

Excellent use can be made of visits and speakers to:

- aid the introduction of quality control and its 'real' application in industry
- provide a clear understanding of industrial practice.
- raise awareness of health and safety procedures/hygiene requirements in the work place.

Students should be actively involved in their learning and should have an opportunity to fully experience and understand the types of learning situations outlined above and apply these to their own work.

It is not necessary for students to undertake all aspects involved in the manufacture of a product. Individual students are only required to act as part of a team and to take an active part in the production of the product.

The centre should develop a range of product specifications and production plans for students to use. Alternatively, a product specification and production plan developed from the work within the first unit may be suitable if being delivered as a 'design and make' project.

Students wishing to attain grades around the grade C boundary, will need to be given opportunities to provide evidence that they did not need help when developing their schedule of manufacture. They must also be given scope to carry out a wide range of quality control techniques. Limited guidance should be provided for the preparation of materials and components, tools, equipment and machinery. Opportunities must be available for students to demonstrate skills and accuracy in the production processes.

Students wishing to attain grades around the grade A boundary will need to be given the freedom to provide evidence of independent planning. They should be given the freedom to use select and use objective quality control techniques. They should also have the opportunity to prepare materials, components, tools, equipment and machinery independently. Opportunities must also be made available for students to demonstrate skills and accuracy in the production process.

Assessment strategies

Learning should be supported by an assessment programme. Opportunities should be available for peer and self-assessment in order to develop students' skills in being responsible for their own learning and development. Although this is not a mandatory requirement within the programme or unit, it is good practice to develop candidates' skills in this area.

Assessment can consist of a combination of formative and summative assessment, depending on the method of delivery.

The assessment grid for this unit indicates the different levels of performances (1 to 3) expected from students. Each level shows descriptors that are attached or linked to the Assessment Objectives (AO) in the specification for the award.

These objectives cover:

- recalling and applying knowledge, skills and understanding
- planning and carrying out investigations and tasks in which they analyse vocational issues and problems
- gathering, recording and analysing relevant information, data and other forms of evidence
- evaluating evidence, making reasoned judgements and presenting conclusions.

In awarding the higher grades the teacher should ensure that students have taken opportunities to work in an independent way, producing comprehensive work in a confident manner.

The formative assessment in the suggested teaching schedule would occur while the students are working through the initial stages covering the *What you need to learn* section of the specification. It may also occur during the making of the product, with the teacher monitoring the students log. The summative assessment will match the Assessment Evidence grid to the students log.

As this unit is internally assessed, the assessment for this unit, although treated holistically, is in six parts:

- the development of a schedule for manufacture
- the use of quality control techniques
- preparation of materials and components
- preparation of tools equipment and machinery
- the safe manufacture of a product to meet client requirements and required quality standards
- evaluation of production plan and schedule of manufacture to suggest improvements.

Suggested delivery/activity schedule

The suggested delivery/activity schedule indicates to the deliverer the order in which to teach the topics, the learning activities and resources associated with Unit 2. The teacher may wish to use or adapt this schedule for use with this unit. The following schedule is for centres wishing to deliver this as a stand-alone unit.

Activity number	Title	Learning/assessment activity	Resources
1	Production planning	Tutor-led discussion/ explanation Student activity – questions and answers	Specifications Textbooks Examples of production plans Case study Pre-prepared questions
2	Schedule for manufacture	Tutor explanation Student activity	Textbooks Examples of production plans Examples of schedules
3	Team work	Tutor-led discussion – team work Students – teamwork Simulated manufacturing activity	Specifications Textbooks Information documents Team work Video recorder Resources for simulated manufacturing exercise
4	Practical activity	Tutor demonstration Student practice Manufacture Tutor briefing and discussion on H+S/Hygiene	Practical materials Tools and equipment H+S/ Hygiene procedures
5	Quality control	Tutor-discussion, explanation and demonstration of quality and quality control techniques (QCT's). Student activity – simulated manufacturing exercise	Specification Textbooks Quality information equipment etc Example of a simulated manufacturing exercise (to cover QCTs)
6	Manufacture	Student activity – manufacture of product	Pre-prepared production plan Blank schedule and work cards Students' manufacturing log proformas Materials, components, ingredients, tools and equipment for manufacture

The teacher should try to match the requirements of the schedule of manufacture to the resources available in the centre.

Suggested learning activities

These provide examples of activities that may be used by the teacher to cover the *What you need to learn* part of the unit. They are designed to give the student the opportunity to practice specific areas of knowledge, understanding and practical skills.

Activity 1

Preparing a production plan

General discussion led by tutor considering the product to be made and the importance of a production plan. The students need to understand and know how to make use of information contained in a production plan. A suitable response from students may be a question answer session, ensuring they understand how to obtain relevant information from a given production plan including a schedule for manufacture.

Activity 2

Developing a schedule for manufacture

Tutor explanation of the schedule for manufacture including, process and assembly stages, sequence and timing, critical control procedures and identification of staffing. Students should understand how to develop a schedule from the detail of a production plan. They should have the opportunity to practise these activities before assessment is undertaken.

Activity 3

Developing an effective manufacturing team

Tutor-led open discussion considering all aspects of what constitutes an effective manufacturing team. Follow up to clarify understanding. The tutor could then explain to the students how an effective team might be improved by:

- allocating and agreeing individual and team targets
- setting individual targets
- ensuring good communication between team members
- ensuring that team members are motivated
- creating an appropriate working environment.

At this stage, the tutor may instigate a simulated activity-based on teamwork, such as a simulated production line, using a constructional toy (eg Lego) where there can be no verbal communication. Students may then evaluate their own contribution and that of the others in the team. This activity may be enhanced by the use of video recording.

Activity 4

Developing manufacturing skills

It is essential that students have the opportunity to practise the skills needed in the manufacture of a final product. These skills will include preparation, processing, assembly and finishing. During this activity, each stage can be considered in detail depending on the product to be manufactured. These practical activity sessions provide an opportunity for students to be introduced to general health, safety and hygiene in respect of the use of tools and equipment in the manufacturing environment. However there will need to be specific learning activities directed towards safety systems and safety equipment. This practise period may also provide useful information needed for the development of the schedule for manufacture. Students should be encouraged to time events to obtain data for inclusion in the schedule.

Activity 5

The application of Quality Control

Tutor-led general discussion considering quality. This will then lead to Quality Control, and how to ensure it occurs. The tutor may wish to list various techniques, especially those appropriate to the product to be made. At then end of this learning session students should be able to:

- inspect, test and compare samples of a product material, component/ingredient
- recognise critical control points
- record data in an appropriate format, using manual or ICT applications
- identify variances from quality standards and suggest possible causes and changes needed to prevent them from recurring
- monitor the progress of production, and identify, record and remedy variance.

A suitable student response would be to practice the application of quality control to a simulated manufacturing activity.

Activity 6

Manufacture of a product

At this stage the students have produced very little that will be summatively assessed, rather they will have gained the knowledge, understanding and techniques required for carrying out the manufacture of a product, while working in a team. It is the students response to this activity, which will form the summative assessment and which will be judged against the assessment grid, proof of which will need to be kept in the portfolio of evidence. This evidence of practical work may take the form of a student's log, which may contain annotated photographs, witness statements etc. as outlined in the 'summary of learning outcomes'.

The tutor will be required to produce a detailed product specification and a production plan for a manufactured product. This product should use at least two components or different materials/ingredients. Where possible the production plan should relate to industrial practices. The student response must be to produce a product made, as far as possible, to the production plan.

The Production Plan

The Production Plan is an essential document, which is used to present information regarding the manufacture of a product.

The plan should contain information about materials, parts and components to be used, processes, tools, equipment and machinery to be used and the sequence of production. It should include critical production and quality control points, production scheduling including realistic deadlines, how quality will be checked and inspected and health and safety factors.

The production plan may be presented in many different formats, designed to suit particular applications.

The following are examples of typical Production Plans for different manufacturing sectors.

Example of an Engineering Manufacturing Production Plan

Customer:		**Product:**		**Drawing number:**			**Date required:**		**Quantity**	
Part number	Material type and size	Parts and components	Sequence of production	Process	Tools and equipment	Speeds and feeds	Health and safety aspects	Quality control checks	Quality standards	Notes

A Production Plan used in other manufacturing sectors may be in the form of several separate sheets as follows:

Gantt Chart

	Time																																																					
Production Stage																																																						

Resource requirements

Type of production stage	Production stage	Capital resources	Human resources	Materials resources	Tooling resources	Service resources	Health and safety aspects	Quality control checks
Material preparation								
Processing								
Assembly								
Finishing								
Packaging								

Processing time

Type of production stage	Production stage	Set up time	No of operations	Operation time	Total operation time	Production stage time
		A	B	C	(B+C)	A+ (BxC)
Material preparation						
Processing						
Assembly						
Finishing						
Packaging						
					Total production time	

Additional resources

Books

Basic Manufacturing
Roger Trimmings et al
19th December 2000
ISBN 0750648805

Intermediate GNVQ Manufacturing
Jim Kelly
1st October 2000
ISBN 1861527136

Advanced Design and Technology
Urry, Norman, Riley and Whittaker
28th September 2000
ISBN: 0582328314

Edexcel INSET

There is a full programme of Inset planned to support this and other GNVQ Manufacturing courses. These are identified in the Edexcel INSET guide for Technology. There is also planned series of Networks throughout the country.

Unit 3: Application of Technology

Introduction

This unit attempts to identify the way technology affects products and companies, particularly in the stages of design and manufacture. It focuses on interesting developments that have changed the ways items are produced. The positive aspects of technology are stressed. Appropriate considerations to improvements in quality, through using technology and the benefits and implications modern technology has for the work force, the wider community, the global environment and sustainability are considered.

This is a practical unit in which the student will investigate the impact of technology covering the following fields:

- food and drink, biological and chemical
- printing and publishing, paper and board
- textiles and clothing
- engineering fabrication.

Unit overview

Background

The aim of the unit is to give the students an understanding of the application of appropriate technology, in the design and manufacture of products.

Summary of learning outcomes

This unit is assessed through an external assessment. The student must be entered for an assessment in **one** of the **six** following sectors:

- engineering fabrication
- mechanical, automotive
- electrical and electronics, process control, computers, telecommunications
- food and drink, biological and chemical
- printing and publishing, paper and board
- textiles and clothing.

Students are asked to answer a range of questions, which relate to the sector chosen. The unit grade will be based on the performance in this external assessment and will be within the range U, G to A, A*. The higher achievers will show increasing depth and breadth of knowledge, skills and understanding, increasing coherence, evaluation and analysis and increasing independence and originality.

The learning from this unit will given students opportunities to:

- investigate the impact of technology on the design and manufacture of different products across engineering and manufacturing sectors
- look at the use of ICT, modern materials and components, systems and control in the application of design and manufacture of products
- understand the impact of these technologies and the advantages and disadvantages it has brought to society
- investigate stages in engineering and manufacture and the use of modern technology.

To achieve a grade F, students will provide evidence to show*:*

In the external test, students will be able to show that they can link products to sectors, know the stages of production and describe technology and its development. Their answers to questions are likely to be short and limited to simple concepts.

To achieve a grade C, students will also show*:*

In the external test, students will be able to demonstrate that they can use technical terms correctly, explain and describe technology and its benefits and limitations. Their answers are likely to be fuller and show greater depth.

To achieve a grade A, students will also show:

In the external test, students will be able to demonstrate that they can explain and describe technology, its benefits and limitations and predict trends in the use of technology. Their answers to questions are likely to expand details more fully.

Links to other units

This and other units will utilise prior learning in design and technology. This unit links with Unit 1 (Designing Products for Manufacture) and Unit 2 (Manufactured Products) where students will have the opportunity to use new technology and materials. This unit may also help them to progress to Vocational A levels in Engineering or Manufacturing. This unit also forms part of a Vocational GCSE in Engineering.

This unit provides some of the underpinning knowledge and understanding for the National Vocational Qualification in Performing Manufacturing Operations and Performing Engineering Operations.

The wider curriculum

Delivery of this unit can also contribute to the students' understanding of moral, ethical, social and cultural issues and European initiatives consistent with relevant international agreements in the following manner:

- **social**: when considering the impact and implications of technology such as the use of robots etc
- **environment**: the use of certain materials
- **European initiatives**: when considering health and safety legislation affecting the use of new materials, components and processes.

Overview of learning and assessment strategies

Teaching and learning strategies

Centres should use a wide range of learning methods in order to achieve the assessment outcomes of this unit. These include:

- question and answer sessions
- visiting speakers
- general instruction in advances in new technology
- interviews and research to determine uses of new technology
- website access
- discussions
- practical use of workshop equipment
- practical activities
- examining individual products
- group 'quiz' on technical terminology
- practical use of CAD systems etc
- producing basic diagrams and mock-ups of designed products using ICT
- research activities
- use of mathematical and scientific techniques and principles
- use of case study material and videos
- visits etc.

The teaching and learning activities should draw on material based in industry, wherever possible. This will help students to develop vocationally focused transferable skills.

Excellent use can be made of visits and speakers to study the impact of technology and see its 'real' application in industry. Students should be actively involved in their own learning and should have an opportunity to fully experience and understand the types of learning situation outlined above and apply these to their own work.

Students will be asked to investigate a given product through pre-release material, which will be notified in September each year. When examining a product, it is useful if it can be taken apart and examined. This helps introduce a practical activity into the unit and provides information about materials and components. When doing so, this will not only maintain student interest but will also allow them to see clearly how products are structured and how they work. An outcome of this work could take the form of a sectioned display, which is annotated by students. Research on the internet will consolidate their findings.

It is helpful if students have seen a modern production process. Students should appreciate that changing technologies affect many aspects of manufacturing and engineering, including design, production planning and operations. For example, automation can be used for quality monitoring. Good simulations of automation and other new technologies can be achieved by using the equipment available from educational suppliers.

The external assessment for this unit will be in the form of a graded test. The sample test provided by Edexcel consists of a series of open-ended questions, some of which indirectly relate to the practical research that students have carried out as part of their learning and

established in their portfolio. Students should draw upon their learning in response to the questions to achieve the higher grades. Other questions are more general and will test the students understanding of general principles and practices of technology.

Assessment strategies

Learning should be supported by an assessment programme. Opportunities should be available for peer and self-assessment in order to develop students' skills in being responsible for their own learning and development. Although this is not a mandatory requirement within the programme or unit, it is good practice to develop the students' skills in these areas.

Assessment should consist of formative assessments depending on the method of delivery. Feedback of student performance is vital to ensure that learning is taking place at an appropriate rate to allow all students access to the external assessment.

The formative assessment in the suggested teaching schedule would occur while the students are working through the initial stages covering the *What you need to learn* section of the specification. Edexcel will carry out the summative assessment in the external assessment.

Suggested delivery/activity schedule

The suggested delivery/activity schedule indicates to the deliverer the order in which to teach the topics, learning activities and resources associated with Unit 3 the teacher may wish to use or adapt this schedule for use with this unit.

Topic	Title	Learning/assessment activity	Resources
1	Introduction to unit and the required product	Tutor input Tutor-led example of technology used in relation to a particular product. Group exercise on choosing possible products to investigate. The pre-release requirement.	Notes and handouts Assignment on new technology Product identification pro-formas List of examples of possible products that could be used. Pre-release material
2	Manufacturing sectors and fields of application	Tutor input Recognising the products of different manufacturing sectors. Recognising the products of different fields of application	Notes and handouts Exercise on relating a list of products to a list of sectors and fields
3	Information and communication technology (ICT)	Tutor input Exercise on types of new technology The advantages and disadvantages of new technology Costs and savings	Notes and handouts Access to practical areas eg CAD, CAM etc Samples of the products Industrial visit Group exercise
4	New materials and components	Tutor input Exercise to identify where new materials are used	Notes and handouts Visiting speaker Video Group exercise
5	Control Technology	Tutor input Exercise to identify different types of control technology , application of automation, robotics and PLC's	Access to new technology Tutor briefing and demonstration by practitioner. Health and safety check Industrial visit
6	Stages in engineering and manufacturing	Tutor input Company visit – identifying stages	Company visit Check list and brief
7	Investigating a product	Practical investigation and research	Pre-release material and instructions Access to research material and internet etc.
8	External assessment preparation	Revision of test papers Guidance on performance	Specimen test papers

Please note students must be **fully** briefed, appropriately supervised, provided with all safety equipment and suitably trained in accordance with the requirements of health and safety legislation before operating any dangerous item of new technology.

Suggested learning activities

These provide examples of activities that may be used by the tutor to cover the *What you need to learn* part of the unit. They are designed to give the student the opportunity to practice specific areas of knowledge, understanding and practical skills.

At this level, students only need to learn about new technology at an introductory level. It is not necessary for students to know how to use the technology at this stage, although practical use or demonstration in areas such as CAD and CAM is usually stimulating and motivational.

Activity 1

Introduction to the unit and the required product

Using product identification pro-formas and a list of examples of possible products that could be used, the tutor outlines the requirements of the unit and explains the requirements of the pre-release material. Students carry out a group exercise in choosing a product, identifying reasons for their selection.

Activity 2

Learning about manufacturing sectors and fields of application

The aim of this activity is to provide the student with a basic appreciation of what constitutes a 'sector' of the manufacturing industry and what sort of products might be produced in any sector and where they are used.

After tutor input on the features of a manufacturing sector and the different fields where products are used and a general class discussion, the following exercise is conducted.

The class is divided in teams of not more than three persons. Suitably displayed for the students use is a list of the major manufacturing sectors including:

- engineering fabrication
- mechanical, automotive
- electrical and electronics, process control computers telecommunications
- food and drink, biological and chemical
- printing and publishing, paper and board
- textiles and clothing.

Students are then provided with a list of about 30 products, all of which are known to the students and they are then is asked to place each product in one or more manufacturing sectors. (For example, a compression spring might be placed in both automotive and mechanical sectors). It is likely that at the feedback stage, some discussion will ensue. It is important that the tutor is flexible and that where there is ambiguity, teams are encouraged to justify their decisions. The teams should also discuss and decide which field of application is suitable for the given products.

Activity 3

Learning about the types of information and communications technology (ICT).

The aim of this activity is to establish the range of ICT. This is important because the student will appreciate the range of ICT applicable to their product. An important part of this activity is for the tutor to arrange a visit to an engineering company in advance and obtain as much information as possible on that organisation's operations.

A visit to the company takes place, before which students are issued with a questionnaire (if the company is co-operative, then they could have notice of the questionnaire). This questionnaire is designed to encourage the students to observe all the various stages of application of ICT and to 'spot' and make a note of the application on their tour of the operations. Students should be encouraged to seek information about advantages and limitations that could promote findings on costs and savings. On their return to the centre, the students work in groups, to identify what ICT was seen and at what stages they were encountered.

Activity 4

Identifying new materials and components

This activity will vary widely between centres and will depend upon the centres links with industry. Not all centres will have access to many modern material structures, such as modern alloys. Using the same product list as in activity 1, with alterations to suit the centre, arrange the students into groups of three or four and ask them to think about what the materials need 'to be' or 'have'. You are trying to get them to realise where materials have been improved with the use of new technology to suit their function.

Activity 5

Identifying different types and application of automation, robotics and PLCs

Again, the best way to achieve this is through an industrial visit. If this is not possible, videos can be used or demonstrations on practical kits. If a visit is used, the students **must** be briefed on health and safety matters first. A similar exercise to that in Activity 3 should be used.

Activity 6

Stages in manufacturing

A company visit to identify the important stages and activities involved in making a product. If the company produces different products, students could independently discover the stages for a particular product by talking to company personnel. Upon returning to the centre, they could present their findings to the rest of the group justifying why these stages are used.

Activity 7

Investigating a product

Using the pre-release material, the students investigate the product for their chosen sector. They should *mirror image* the activities previously carried out.

Activity 8

External assessment preparation

Teachers must ensure students are prepared for the external assessment. This will include familiarising students with the format and structure of the assessment. They should be clear about the rules and regulations of external assessments and they should also be reminded of the duration and aims of the assessment. In other words, they should be well rehearsed in the format and structure of external assessments.

Students should understand the terminology of assessment, eg describe, explain, and evaluate. Teaching time should be allocated to support students with this. The external assessment aims to assess the vocational knowledge skills and understanding of the student. Teachers should be aware of marking schemes and their implications and students should practise effective time management for the external assessment. Using exemplar and past papers allows students to practice in examination conditions.

Suggested assessment activities

These are examples, which you can develop to provide students with opportunities to demonstrate their knowledge and understanding.

These activities are only **examples** and should **not** be regarded as the assessment activities for this unit. They can be used as a formative assessment tool to allow feedback of student performance during their learning.

Activity 1

Choosing and analysing a product and planning research for the investigation

After fully briefing the students and working through an example, the tutor should allow the students to choose a manufactured product around which they will base their investigation. Bearing in mind the level of the course, it is advisable for students, in conjunction with the tutor, to pick a product that is:

- relatively non-complex products (eg **not** a car, computer, central heating boiler etc, but something like a small child's toy, a CD player)
- supported by information from the manufacturer, trade papers, advertising, the internet or publicity material
- ideally produced locally, thus allowing a direct approach and possibly a visit by the student.

Students should draw up an action plan of what information they need to obtain about the product, how they will obtain this and when this will be achieved. Again this should be done with the support of the tutor. Students should make a clear note of their reasons for choosing the product (eg it may be produced at a factory where a relative is employed) and what engineering or manufacturing sector they consider the product to be in, with justification.

Activity 2

Researching the product of their choice

Students now carry out the research action plan they prepared in the above activity. To ensure that all the investigative requirements stated in the unit specification are being met, the tutor should check what the student plans to research. The tutor may supply the students with a form on which to collect information or may allow students to prepare their own form. Students then conduct the research in the ways that they have planned, revising and modifying their action

plan as necessary. It is worthy of note that many companies are slow in responding to requests for information, especially if they have websites on which information can be requested or is already provided. This information is then collated and is incorporated into sections, possibly in a portfolio under the areas of:

- information about their chosen products based on data from manufacturers and suppliers
- an investigation of the product
- details of the impact this product has had on people and companies
- a description of the importance of new technology on the sector of engineering that makes the product.

External assessment

The external assessment for this unit will be in the form of a graded test. The sample test provided by Edexcel consists of a series of open-ended questions, some of which directly relate to the practical activity that they have carried out as part of their learning and pre-release activity. The students should draw upon their learning in response to the questions to achieve the higher grades. Other questions are more general and will test the students understanding of general principles and practices of appropriate technology.

The assessment may require additional materials such as pre-released material and case studies. This may require additional support, which should be planned for as part of the teaching strategy.

This an open-ended test, where students are able to bring their research into the examination room and use it as reference material. None of this research is to be sent to Edexcel or marked as part of the examination.

Students need to be able to apply the knowledge, skills and understanding of the unit to the demands of the questions set. The ability to transfer knowledge, skills and understanding to different situations is an invaluable preparation for employment, training and further education. External assessment is one example where this transference is critical, eg coping with the controlled conditions of an external assessment, the imagined scenarios and responding to questions.

Additional resources

Because of the nature of this unit, it is unlikely that textbooks will be of much use to the student, and much reliance will be placed upon materials prepared by the teacher or materials supplied through manufacturing organisations' own literature. The internet will be of particular interest to students wishing to gain a broad range of information on products and technology.

For an extended list of potential resources, consult *Appendix A*.

Employers' and manufacturers' federations, consult *Appendices B* and *C*.

A comprehensive range of products, parts and components are required for product investigation.

Internal assessment procedures

Supervision of students and authentication of work submitted

Students must submit a portfolio of work for each of Units 1 and 2. Teachers are expected to guide and advise students in the production of their portfolios. Teachers should monitor progress, to ensure that the work is appropriate for the requirements of the specification. While some work, particularly in the early planning stages, may take place in groups, the input of the individual student should be clearly identified and the judgements and conclusions reached must be their own. The GCSE, GCE, VCE and GNVQ Code of Practice requires that assessors record full details of the nature of any assistance given to individual candidates that is beyond that of the teaching group as a whole, but within the parameters laid down in this specification. The level of assistance should be taken into account when assessing students' work, as indicated in the guidance section that accompanies each internally assessed unit in the specification. In addition, sufficient work must take place under direct supervision to allow the teacher marking the work to authenticate each student's work with confidence.

If student process skills are being assessed, it is important that Witness Statements and Observation records are completed by assessors, to authenticate student work and provide evidence that students have achieved the level of performance required in the assessment grid.

Assessment

The work of each student must be assessed using the assessment evidence grids, which contains criteria statements and bands of response. The assessment must be completed by centres on the Mark Record Sheets which are used to convert achievement levels to marks. A copy of these forms are contained in the appendix at the back of this document and should be photocopied and attached to each students portfolio.

Annotation

Annotation is a mandatory requirement for internally assessed work and is used to:

- help the moderator to understand how and where marks for each assessment criteria have been awarded
- describe where students have received help beyond normal learning support or where students have been rewarded for initiatives that are not immediately apparent from the evidence presented
- explain any other features of a students work that will assist the moderator in understanding how a particular assessment was arrived at

  The minimum requirement for annotation is to complete the annotation column on the Mark Record Sheet by listing the portfolio page numbers where evidence can be found for each of the assessment criteria.

  Further comments can be carried out on the back of the Mark Record Sheet. Detailed annotation will help a moderator to agree a centres marks.

Annotation should not be written directly onto students work.

Standardisation within the centre

It is the centres responsibility to ensure that where more than one teacher has marked the work, internal standardisation has been carried out. This procedure ensures that the work of all students at the centre is marked to the same standards and that an accurate rank order is established.

Internally assessed portfolios

Following assessment, all portfolios must be available for inspection by Edexcel. Each students portfolio should contain only the work used for awarding marks for the assessment.

Portfolios must have a title page with the relevant specification name and number, candidate name, candidate number, centre name, centre number, and date. The first page of the portfolio should be a contents list and pages should be numbered throughout the portfolio.

A sample of the work will be requested and must be sent to Edexcel to arrive no later than 15 May in the year of the examination. No practical work is to be submitted to Edexcel unless specifically requested.

The moderated coursework will be returned to centres in the autumn term in the year of the examination. Edexcel reserves the right to retain examples of folders for archive, grading or training purposes.

Support and training

There is a full range of support material designed for each GCSE in a vocational subject.

The range includes:

- specimen tests and associated mark schemes
- sample materials for delivering the units – tutor support packs
- sample materials for assessing the internal units
- examiner reports
- the Edexcel website – www.edexcel.org.uk.

Edexcel delivers a full INSET programme to support these GCSEs. This includes generic and subject-specific conferences, seminars, workshops and customised events for individual centres.

Further information on INSET programmes can be obtained from Customer Services on 0870 240 9800

E-mail for enquiries – trainingenquiries@edexcel.org.uk
E-mail for bookings – bookingenquiries@edexcel.org.uk

Information concerning support material can be obtained from:

- Edexcel Publications
  Adamsway
  Mansfield
  Notts. NG18 4FN

  Tel: 01623 467467
  Fax: 01623 450481
  E-mail: publications@linneydirect.com

Appendix A

Publications and materials list

The following list contains publications and other media resources that have been found useful by teachers. The list is not exhaustive and you are encouraged to contact the main educational publishers, awarding bodies and employer organisations to discover what additional materials and resources are being developed for this qualification.

Title	Format	Publisher
Confirming Standards: Intermediate GNVQ Manufacturing Request a catalogue	Booklet	QCA Publications Order line 01787 884444
Part 1 GNVQ Handbook	Booklet	QCA Publications Order Line 01787 884444 Code. QCA/00/562
Teaching CAD/CAM	Booklet	DATA Tel: 01789 470007 ISBN 1 898788 42 1
Aiming at world class Manufacturing and other pamphlets	Leaflet	DTI Tel: 020 7215 2501
Annual review	Journal	British Cake, Chocolate and Confectionery Alliance Tel: 020 7504 5222
Hungry for New Talent	Pack	Meat Training Council Tel: 01908 231062
GNVQ Information Pack	Pack	Training Alliance for Surface Coatings Tel: 01372 360660
Paper Industry Resource Pack	Pack	The Pulp and Paper Information Centre Tel: 01793 887468
Mikell P. Groover. Automation, Production Systems and Computer Integrated Manufacturing	Book	Pearson Educational Tel: 01279 623 921/928 ISBN 0 1305 4652 6
Roger Tammings, Gillian Whitehouse et al. Basic Manufacturing	Book	Butterworth-Heinemann Tel: 01865 888080 ISBN 0 7506 4880 5
Winifred Aldrich ed. CAD in Clothing and Textiles	Book	Blackwell (Science) Tel: 01865 206 206 ISBN 0 6320 3389 34
Philip R. Ashurst Chemistry and Technology of Soft Drinks and Fruit Juices	Book	Sheffield Academic Press Tel: 0114 255 4433 ISBN 1 8507 5857 3

Title	Format	Publisher
Information and Fact Sheets	Book	British Soft Drinks Association Ltd. Tel: 020 7430 0356
Thomas E. Vollman et al. Manufacturing Planning and Control Systems	Book	McGraw Hill Tel: 01628 623432 ISBN 0 07114 8906
Philip Ostwald and Jairo Munoz Manufacturing Processes and Systems	Book	John Wiley and Sons Tel: 01243 779 777 ISBN 0 4710 4741 4
Collin Chapman and Mel Pearce Collins Real World Technology Working With Materials	Book	Collins Educational ISBN 0 00 327351 2
Graham Vickers Style in Product Design	Book	Gower Publishing Co. Ltd. Tel: 01252 331551 ISBN 0 85072 277 2
The KEIN CD ROM	CD	KEIN Educational Trust Tel: 01484 225724
Manufacturing and Engineering CD ROM and other resources Request a catalogue	CD	Technology Enhancement Programme Tel: 020 7447 0342
Better By Design and Designs on your….	Video	Channel 4 Television/Design Council www.channel4.com/nextstep www.design-council.org.uk
Teacher Resource pack on Food Manufacturing	Mixed media	NATHE/Wicken Fen Tel: 01353 723103
Various resources – ask for catalogue	Mixed media	Meat and Livestock Commission Tel: 01908 677577
Various resources – ask for catalogue	Mixed media	Metals Industry Tel: 0114 244 6833
Various resources – ask for catalogue	Mixed media	Corus Educational Resources Tel 01937 840243
Various resources – ask for catalogue	Mixed media	British Pharmaceutical Industry Tel: 020 7930 3477

Appendix B

Vocational links in the manufacturing sector

Introduction

The world of manufacturing is wide and varied and covers many sectors. It would be impossible to include everything that is available for each sector, so this is not an exhaustive list. It will however, provide access to internet sites that will prove profitable and lead you in your search for new sources of appropriate materials and resources. Some sites have information and resources that have been specifically produced for education (for example the British Soft Drinks Association site). The trade associations and federations have a great deal of useful information, some of it technical, while some may refer to national standards. For example, look at the site for the Metal Packaging Manufacturers Association and follow the design and manufacture links to see how drinks cans are made.

Useful websites

The sites below will provide many links to the manufacturing sectors. However, centres are also encouraged to explore manufacturing industries in their local area. A copy of your local Yellow Pages and a Chamber of Commerce directory will prove invaluable in your endeavour to develop productive industry links.

Organisation	Web address
ADAM	www.adam.ac.uk
Aluminium Recycling	www.alupro.org.uk
American Chemical Society	www.acs.org/education
Association of British Health-Care Industries	www.abhi.org.uk
Association for Instrumentation, Control and Automation	www.gambica.org.uk
Association of Suppliers to the British Clothing Industry	www.asbci.co.uk
Association of Suppliers to the Furniture Industry	www.asfi.org.uk
Bakels Around the World	www.bakels.com
BBC	www.bbc.education
Ben & Jerry's	www.benjerry.com
Bio Industry Association	www.bioindustry.org.uk
Bird's Eye	www.birdseye.com
Biscuit, Cakes and Confectionery Alliance	www.bccca.org.uk
Boots	www.boots.co.uk
Brewers and Licensed Retailers Association	www.beerandpub.com
British Abrasive Federation	www.the-british-abrasives-federation.org.uk
British Aerosol Manufacturers Association	www.bama.co.uk
British Ceramic Confederation	www.ceramfed.co.uk
British Coatings Federation	www.coatings.org.uk
British Companies	www.britishcompanies.co.uk

Organisation	Web address
British Footwear Association	www.britfoot.com
British Furniture Manufacturers Association	www.bfm.org.uk
British Gear Association	www.bga.org.uk
British Hardware and Houseware Manufacturers Association	www.bhhma.co.uk
British Jewellery and Giftware Federation	www.bjgf.org.uk
British Lubricant Federation	www.blf.org.uk
British Meat Education Service	www.bmesonline.org.uk
British Nutrition Foundation	www.nutrition.org.uk
British Plastics Federation	www.bpf.co.uk
British Rubber Manufacturers Association	www.brma.co.uk
British Secondary Metals Association	www.bsma.org.uk
British Soft Drinks Association	www.britishsoftdrinks.com
British Standards Institute	www.bsi.org.uk/education
British Sugar	www.britishsugar.co.uk
British Textile Technology Group	www.bttg.co.uk
British Woodworking Federation	www.bwf.org.uk
Cadbury	www.cadbury.co.uk
Camden and Chorley Wood Research Association	www.newfoods.com
Canadian Fashion and Design	www.ntgi.net/ICCF&D/index2.htm
CAPITB Trust	www.careers-in-clothing.co.uk
Catering Equipment Suppliers Association	www.cesa.org.uk
Centre for Alternative Technology	www.cat.org.uk
Channel 4 Education	www.channel4.com
Coca Cola	www.coke.com
Computer Textile Design Group	www.ctdg.nildram.co.uk
Confederation of British Industry	www.cbi.org.uk
Confederation of British Metalforming	www.britishmetalforming.com
Confederation of British Wool Textiles	www.cbwt.co.uk
Cosmetic, Toiletry and Perfumery Association	www.ctpa.org.uk
CREDA	www.creda.co.uk
Cutlery and Allied trades Research Association	www.catra.org
Dalgety	www.dalgety.co.uk
Defence Manufacturers Association	www.the-dma.org.uk
Department for Education and Skills	www.dfes.gov.uk
Department for Trade and Industry	www.dti.gov.uk
DTI Design Policy Unit	www.lowpay.gov.uk/design/
DeskArtes	www.deskartes.com
Design and Technology Association	www.data.org.uk
Design Council	www.design-council.org.uk
Dupont	www.dupont.com
Dyson Appliances	www.dyson.com
Economatics	www.co.uk/education
Edexcel Foundation	www.edexcel.org.uk
Electrical Installation Equipment Manufacturers Association	www.eiema.org.uk
Engineering Council	www.engc.org.uk
Engineering Employers Federation	www.eef.org.uk
Federation of the Electronics Industry	http://fm6.facility.pipex.com/fei
Fiber Architects	www.fiberarchitects.com

Organisation	Web address
Flour Advisory Bureau	www.fabflour.co.uk
Food and Drink Federation	www.foodanddrinknto.org.uk
Food and Farming Education Service	www.fma.org.uk
Food Future	www.foodfuture.org.uk
Food Ingredients on the Internet	www.fioti.com
Food Online	www.foodonline.com
Garden Industry Manufacturers Association	www.gima.org.uk
Glass National Training Organisation	www.glass-training.co.uk
Health and Safety Executive	www.hse.gov.uk
Hotpoint	www.hotpoint.co.uk
How Stuff Works	www.howstuffworks.com
IDATER	www.iboro.ac.uk
Institution of Electrical Engineers	www.iee.org.uk
Institution Of Food Science & Technology	www.easynet.co.uk
Intermediate Technology	www.itdg.org.uk
International Apparel Federation	www.iafnet.org/associates
International Technology Education Association	www.itea.org.uk
Kellogg	www.kelloggs.co.uk
Kettle Foods	www.kettlefoods.com
Kitchen Specialists Association	www.ksa.co.uk
Qualifications and Curriculum Authority	www.qca.org.uk
Leatherhead Food Research Association	www.lfra.co.uk
Leisure and Outdoor Furniture Association	www.lofa.com
Lighting Industry Federation	www.lif.co.uk
Machine Tool Technologies Association	www.mtta.co.uk
Marks and Spencer	www.marks-and-spencer.co.uk
Meat and Livestock Commission	www.britishmeat.co.uk
Mechanical and Metal Trades Confederation	www.metcom.org.uk
*Metal Packaging Manufacturers Association	www.mpma.org.uk
Metals Industry	www.metskill.co.uk
National Ass. Of Advisors and Inspectors D&T	www.naaidt.org.uk
National Association of Teachers of Home Economics	www.users.globanet.co.uk
National Dairy Council	www.ndc.co.uk
National Grid for Learning	www.ngfl.gov.uk
Nestle	www.nestle.com
Nilex Technology	www.nilex.com
Northern Foods	www.northern-foods.co.uk
Nuffield Design and Technology	www.nuffield.org.uk
Nutrition Society	www.nutsoc.org.uk
OCR	www.ocr.org.uk
Office of National Statistics	www.ons.gov.uk
Packaging Federation	http://dir.dotpackaging.com
Pastry Wiz Food Resource Centre	www.pastrywiz.com
Pet Food Manufacturers Association	www.pfma.com
Phileus Fogg Snacks	www.phileusfogg.com
Polymer National Training Organisation	www.polymernto.org.uk
Proctor Department of Food Science	www.food.leeds.ac.uk

Organisation	Web address
Royal College of Arts School of Fashion and Textiles	www.rca.ac.uk
Saveguard Innovative Textile Products	www.saveguard.com
Seafish	www.seafish.co.uk
SETNET	www.setnet.org.uk
SI Geosolutions	www.fixsoil.com
Smallpiece Trust	www.smllpiece.co.uk
Society of British Aerospace Companies	www.sbac.co.uk
Society of Marine Industries	www.bmec.org.uk
Steels and Metals Industry	www.sinto.co.uk
Sugar Bureau Scientific Information	www.sugar-bureau-sis.co.uk
Technology Colleges Trust	www.tctrust.org.uk
Technology Enhancement Programme	www.tep.org.uk
The Association of British Pharmaceutical Industry	www.abpischools.org.uk
The Association of Master Upholsterers and Soft Furnishers	www.upholsters.co.uk
The British Apparel and Textile Confederation	www.batc.co.uk
The British Council	www.britcoun.org/arts/design/projects.htm
The British Furniture, Furnishings and Interiors Industry (FFINTO)	www.ellisfurniture.co.uk
The Centre for Sustainable Design	www.cfsd.org.uk
The Federation of Bakers	www.bakersfederation.org.uk
The Food Foundation	www.fooddirectory.co.uk
The National Museum of Science and Industry	www.nmsi.ac.uk
The Paper Federation of Great Britain	www.paper.org.uk
The Society of Motor Manufacturers and Traders Association	www.smmt.co.uk
The Textile Institute	www.texi.org.uk
The Trade Association Forum	www.martex.co.uk/trade-associations/index.htm
UK Cleaning Products Industry Association	www.ukcpi.org
United Kingdom Weighing Federation	www.ukwf.org.uk
Unilever	www.unilever.com
United Biscuits	www.united biscuits.co.uk
Wool Works	www.woolworks.org.uk
Young Engineers	www.youngeng.org.uk

Appendix C

Work placement information

Introduction

Work placements may be the first time a student experiences the real world of work. They are also an opportunity for students to experience a potential career they may be considering.

Relevant work experience can provide students with important experiences such as:

- developing motivation. Students will see their skills and abilities applied in a realistic setting. They will also identify others, which they need to acquire in order to succeed
- acquiring realistic aspirations. Reassuring students who have less confidence in their abilities and presenting a true picture to those who glamorise careers
- the opportunity to see a range of related work activities in the same environment, such as in a hospital, day care centre, engineering workshop or large factory
- experiencing both the variety and reality of the working week. Seeing the balance between the inspiring, creative activities alongside the repetitive but necessary tasks needed to get a job completed to a deadline.

Liaising with potential organisations

Establishing a partnership with a local manufacturing company or organisation should be carefully considered.

It is important to take into account the time taken up in planning, participating and reviewing work experience activities. Large organisations may be in a position to absorb these costs, but small organisations or businesses may be less well placed and reluctant to offer work experience. Teachers must be flexible and sensitive to these issues.

Teachers should be able to offer a wide range of work experience opportunities to students if sufficient thought is given to the analysis of manufacturing opportunities.

Work placements for teachers

It is important that teachers are not isolated from the rapid changes in manufacturing industry. Teachers who are continually updated and have recent industrial experience are able to give students confidence and greater motivation. Regular industrial updating, or the opportunity to extend their specialist knowledge, enables teachers to ensure the currency and relevance of all aspects of their work.

There are many benefits to be gained from teacher placements:

- personal benefits – providing the opportunity to look at different working conditions and environments from those in education. Teachers will also benefit from seeing how transferable skills can be used in both education and manufacture
- professional development – reassessing the delivery of the course in light of knowledge gained through the work placement. A greater understanding of the industry's needs should, potentially, motivate both staff and students

- a new perspective on difficult management issues and an understanding between education and the world of manufacture will be gained
- developing work experience contacts to provide a network for future work placements or other manufacture-based activities for staff and students.

Work placement provision

A look at the aims for this manufacturing course will emphasise the absolute necessity of schools and colleges to link with local manufacturing industry.

These links will:

- enable students to develop a broad knowledge and understanding of the manufacturing industry, its organisation products and processes
- prepare students for employment, including work-based training and progression to level 3 qualifications
- provide an insight into manufacturing for those students pursuing other career pathways
- introduce the skills, knowledge and understanding needed by those considering a career in the manufacturing industry.

Direct links with the workplace will be necessary to enable students to fulfil specified requirements, obtain information and provide direct access to knowledge and expertise. Additionally, there are clear benefits for teachers and employers to form good partnership links. These can be summarised as follows:

The benefits of partnership links

For schools and colleges, these links provide:

- contacts and local networks for teachers
- people who can give their time to work alongside teachers and students in school or college, eg mentors
- a background of specialist experience and expertise
- access for students to work experience and extended work placements, specialist equipment, materials and other resources
- motivation for students through relevant experiences by applying their learning in a vocational setting
- access to national, European and international networks, which are not usually accessible to education establishments
- opportunities for professional development placements for teachers
- expertise and resources to work collaboratively in the development of vocationally relevant materials and activities, assignments, design briefs etc
- opportunities to prepare students for progression into employment and training, helping them become more informed about employment and training opportunities and work practices.

For employers and other organisations these partnership links provide opportunities to:

- supplement their training and development programmes
- enable employees to enhance their professional development, eg completing NVQ qualifications by supervising students in the workplace or working alongside them in school or college
- help develop relationships with students who may become future employees/awareness of their potential
- raise employer awareness about the new GCSE in Manufacturing, the difference between this qualification, NVQs and other educational issues and initiatives
- allow employers to participate in the development of the vocational curriculum, through writing learning materials, devising assignments, producing product briefs, providing products for analysis, classroom support etc
- raise the profile of the organisation.

Maintaining partnership links

Consider the following when setting up and maintaining links:

- remember that your school or college will already have a bank of existing links that you could utilise. Check with the person responsible in your establishment for overseeing these links before you make an approach
- keep the person responsible for these links informed of your progress or difficulties
- identify key sources and organisations that can provide addresses and phone numbers, eg the Education Business Partnership, Local learning Skills Council
- decide which organisations will have the focus you require. Most manufacturing companies will be able to provide useful settings for aspects of the qualification
- don't be afraid to make contacts but avoid inundating the same link with too many requests
- set side some time to spend on the phone
- be clear about exactly what you need from the organisation
- be prepared to establish good relationships and be reasonable with your requests
- don't expect every call to be successful
- don't sound demanding or too aggressive on the phone
- arrange a preliminary meeting to discuss your needs. Take a copy of the specifications and the Key theme grid to leave with the employer
- have a list of objectives and outcomes in mind. However be open minded to other possibilities that may arise from the link
- prepare to explain your work to the employer, but avoid educational jargon
- don't ask for too much too soon
- try to think of some mutual benefit that could be provided by your work
- be enthusiastic about the course, your students and manufacturing
- don't give up if you can't get what you want. Still try to establish some useful contact
- make clear plans about what will happen and when, before you conclude your discussions
- write to your contact confirming any discussions

- make sure that a letter of thanks goes to participants after an event or a placement etc
- maintain the link and involve people in future activities.

Arranging work related opportunities

Outlined below is a checklist for arranging work-related opportunities:

- a range of suitable host organisations has been researched and contacted
- the nature and purpose of the provider's organisational activities have been identified
- aspects of the provider's routine activities have been matched against the course specifications and requirements
- agreed outcomes for work related learning have been negotiated with the provider and agreed in writing
- a range of work related learning activities have been identified and agreed
- host organisation representatives have been allocated to monitor students' activities, progress and achievements in accordance with the GCSE specification
- a sufficient supply of suitable placements has been identified
- plans are in place to accommodate anticipated shortfalls in provision
- opportunities for work related learning have been discussed with students and appropriate guidance given
- students have been given the opportunity to negotiate their own placement opportunities
- appropriate personnel, both in school/college and the host organisation have been informed of the placement allocations
- students have details of work based projects and know how they relate to the course requirements
- students have been provided with clear and accurate information regarding their rights and responsibilities when on placement
- students have been given details of all essential information needed during the period of work related learning
- students have been able to make a preliminary visit to the host company
- prior to the activity an action plan is discussed with the students and the employer, to ensure placement purposes are understood
- agreed action plan and student progress is reviewed and modified with support from placement supervisor
- parents have been informed about the nature and purpose of the opportunities for work related learning
- parental consent (school students) has been obtained prior to placement opportunity being confirmed
- parents have all the necessary information concerning placement activity, prior to its commencement
- school/college staff roles and responsibilities have been clearly and accurately outlined prior to its commencement
- staff have comprehensive information about the students for whom they are responsible

- procedures for visiting students and monitoring their progress have been established and are being applied
- records of student progress are being kept
- a named person in the host organisation has been given full and accurate information
- host organisation knows who and how to contact the student's school/college teacher
- host organisation informed of any special requirements and needs regarding students
- placement supervisor has agreed to respect confidentiality of student information
- opportunities exist to review outcomes of link activity with host organisation
- arrangements for transport have been made and students informed of these
- health and safety and insurance checks have been authorised and the placement approved
- school/college and employer know and implement restrictions regarding placements for young people
- students have proper insurance cover, this will be through both the school/ LEA/college **and** the company's public liability insurance.

Useful resources

Work Experience Learning Frameworks, developed by the Centre for Education and Industry (CEI) at the University of Warwick, have been devised to enable teachers, employers and young people to plan successful work experience placements that benefit everyone involved.

The *Frameworks* are devised using the relevant National Occupational standards, which means that they are linked closely to NVQ statements applicable to specific vocational contexts. The statements selected and the activities chosen for *Frameworks,* are developed with guidance from employers.

Research is carried out involving key employers who have experience of offering work placements so that the *Frameworks* represent real skills and experiences that a young person can develop during a placement.

The Frameworks can be used to prepare students for placements, set learning targets, debrief students and prepare employers.

Go For It – a resource pack for work experience preparation to challenge stereotypes and promote equal opportunities – CEI/DFEE, 2000

Learning from Work Experience, QCA 1998, defines National Quality Standards for work experience.

Work Experience and the Law, Anthony Johns, CEI (new edition forthcoming) is a useful handbook.

Appendix D

LSDA resources

Our resources have a deserved reputation for being practical and accessible. They are prepared with the busy practitioner in mind who needs clear, accurate and relevant guidance and information. We work closely with the QCA and the awarding bodies, to ensure our publications contain relevant and accurate information. Although some have been written for GNVQ and AVCE, the information within the publications and resources can be applied to the new GCSEs.

Industry information packs

Industry information resource packs designed to enable GNVQ teachers to introduce a greater element of work relatedness into GNVQ programmes, providing students with real work data and making the best and widest use of the available information about industry sectors. Working with the National Training Organisations (NTO's) and employers, the Agency has produced a series of information packs that explain how particular industries operate.

Each pack covers:

- processes and methods used
- statistics
- information on job roles, careers and training
- raw data about production, sales, staffing, transport etc
- guidance on interacting with the industry.

The packs contain authentic working documents supplied by various organisations and companies. Available as manuals for £25 each, order from the helpline.

The LSDA can be contacted at:

- Learning and Skills Development Agency
  Regent Arcade House
  19-25 Argyll Street
  London W1F 7LS

  The help-line number is 0207 297 9144

Titles in the series include:

- Art and Design
- Business and Retail
- Construction
- Engineering
- Health and Social Care
- Hospitality and Catering
- Information Technology
- Leisure and Recreation
- Manufacturing
- Media
- Science
- Travel and Tourism

Appendix E

Observation Record

Candidate name:	
Unit title:	Candidate number:

Activity context:
This may be provided by the assessor or candidate

Assessment evidence:
Refer to the assessment grids reproduced from the specification

Observation notes:

Specific comments on candidate performance that demonstrate achievement of the assessment evidence

Assessor name:

Assessor signature:

Date:

Observation Records

What is an Observation Record?

An Observation Record is a document which records statements of student performance.

It relates directly to the criteria in the Assessment Evidence grid included in each unit specification. It may confirm achievement or provide specific feedback on candidate performance against national standards

Guidance on completing an Observation Record

Since an Observation Record will provide primary evidence, it is essential that the recording of performance is sufficiently detailed to enable others to make a judgement as to the quality and sufficiency of candidate performance and confirm that national standards have been achieved.

Observation Records are often accompanied by supporting/additional evidence. This may take the form of visual aids, handouts, preparation notes, cue cards, diaries, log books, and peer assessment records. It is essential that where present, these are included in the learner evidence. Where visual aids and handouts are used, note should be made on the Observation Record as to how these were used and their effectiveness.

The assessor of the qualification being undertaken by the candidate completes the Observation Record, therefore must have direct knowledge of the specification to enable an accurate assessment decision to be made.

An Observation Record has greater validity than a Witness Statement since it is capable of recording an assessment decision.

All Observation Records must be signed and dated by the assessor.

Appendix F

Witness Statement

Candidate name:

Unit title:	Candidate number:

Activity context: Outline of the activity and its purpose. This may be written by the candidate prior to the observation

Assessment evidence: Refer to the assessment grids reproduced from the specification

Observation notes:

Specific comments on candidate performance that demonstrate achievement of the assessment evidence

Witness name:	Witness signature:
Job role:	Date:
Assessor name:	Assessor signature:
	Date:

Witness Statements

What is a Witness Statement?

A Witness Statement is a document which records statements of learner performance.

It is completed by someone other than the Assessor of the qualification. This may be someone who does not have direct knowledge of the assessment evidence, but who is able to make a professional judgement about the performance of the candidate (for example, a work placement supervisor, technician, librarian)

Guidance on completing a Witness Statement

The quality of a Witness Statement can be greatly improved if the 'witness' is provided with the assessment evidence from the specification so that accurate reference can be made to this in relation to the success of learner performance when recording details on the Witness Statement.

The candidate may provide a statement of context on the Witness Statement.

A Witness Statement does not confer an assessment decision. When making an assessment decision, the assessor must consider the validity of the information contained within the Witness Statement, noting the relevant professional skills of the 'witness', along with any other supporting evidence, before making a final judgement.

As Witness Statements are often used to record practical performance, especially in the workplace, it is important that the person responsible for the completion of the document is identified by the Assessor at the outset.

All Witness Statements should be signed and dated by the 'witness' together with clear details of their job role.

It is the assessor's responsibility to ensure the authenticity of Witness Statements. It may be helpful to collect specimen signatures. A telephone call to thank the witness for providing evidence may also provide evidence of the authenticity of the Witness Statement.

Witness Statements which are to be taken into consideration for assessment purposes must also be signed and dated by the assessor.

Opportunities for the submission of additional Witness Statements should be encouraged as this provides further evidence of learner performance, for example where candidates have taken part in more than one work placement.

Appendix G

GCSE Manufacturing (Double Award) – Unit 1 Mark Record Sheet

Centre no:	Centre name:	Internal moderator name:		
Candidate No:	Candidate name:	RESUBMISSION OF WORK	ALL/MOSTLY AMENDED	
Series number			SOME AMENDMENTS	
			NO AMENDMENTS	

Unit 1: Designing Products for Manufacture

Assessment evidence	Annotation and page number	**Mark band**			Centre mark	**Edexcel use only**
		1	2	3		
an analysis of the client design brief and information about key features		1 - 2	3 - 4	5 - 6		
details of the product design and material constraints		1 - 2	3 - 4	5 - 6		
details of production requirements and quality standards		1 - 2	3 - 4	5 - 6		
a range of design ideas and evidence of testing them		1 - 2	3 - 4	5 - 6		
evidence of how you tested and justified your final solution		1 - 2	3 - 4	5 - 6		
evidence of how you selected and used presentation techniques		1 - 2	3 - 4	5 - 6		
evidence of how you responded to external feedback and modified your design proposal		1 - 2	3 - 4	5 - 6		
		FINAL TOTAL				

Edexcel moderator use only		
Number:	Name:	Signature:

Appendix H

GCSE Manufacturing (Double Award) – Unit 2 Mark Record Sheet

Centre no:	Centre name:	Internal moderator name:		
Candidate no:	Candidate name:	RESUBMISSION OF WORK	ALL/MOSTLY AMENDED	
Series number:			SOME AMENDMENTS	
			NO AMENDMENTS	

Unit 2: Manufactured Products

Assessment evidence	Annotation and page number	**Mark band**			Centre mark	**Edexcel use only**
		1	2	3		
worked as part of an effective team		1 - 2	3 - 4	5 - 6		
used a production plan and developed a schedule for manufacture		1 - 2	3 - 4	5 - 6		
used quality control techniques and identified problems		1 - 2	3 - 4	5 - 6		
prepared and used materials and components safely		1 - 2	3 - 4	5 - 6		
prepared and used tools, equipment (including appropriate use of ICT) and machinery safely		1 - 2	3 - 4	5 - 6		
manufactured your products safely to meet production requirements and conform to standards		1 - 2	3 - 4	5 - 6		
modified the production plan and schedule for manufacture		1 - 2	3 - 4	5 - 6		
		FINAL TOTAL				

Edexcel moderator use only		
Number:	Name:	Signature:

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