BTEC Higher Nationals

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MANUFACTURING ENGINEERING

Specification

LEVEL 4 HNC

LEVEL 5 HND

QCF Accredited

Issue 4
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ALWAYS LEARNING

PEARSON

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This specification is Issue 4. Key changes are sidelined. We will inform centres of any changes to this issue. The latest issue can be found on the Edexcel website: www.edexcel.com

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Edexcel BTEC Level 4 HNC Diploma in Manufacturing Engineering

Edexcel BTEC Level 5 HND Diploma in Manufacturing Engineering

The Qualifications and Credit Framework (QCF) has been introduced to replace the National Qualifications Framework (NQF). It recognises achievement through the award of credit for units and qualifications, working at all levels between Entry level and level 8.

To accommodate the new framework we have taken the opportunity to revise the academic level and size of the Edexcel BTEC HNCs (Higher National Certificates). These are now at level 4 and are a minimum of 120 credits in size. They have been nested within the structures of the Edexcel BTEC HNDs (Higher National Diplomas).

Edexcel BTEC HNDs remain as level 5 qualifications. They are a minimum of 240 credits in size.

The qualifications remain as Intermediate level qualifications on the Framework for Higher Education Qualifications (FHEQ). Progression to Edexcel BTEC Higher Nationals continues to be from level 3 qualifications and progression from Edexcel BTEC Higher Nationals will normally be to qualifications at level 6. Learners' progression routes do not necessarily involve qualifications at every level.

As a nested qualification the HNC is an embedded component of the HND. However, it can be taken as a stand-alone qualification.

If a learner enrols for an HNC they would be eligible to gain a grade for the HNC. If they then move onto an HND, the learner is graded on their HND performance. The grade for the HND will include units from the previously achieved HNC.

If a learner opts to take an HND from the start, then on successful completion of the HND they will receive one grade for the HND achievement only.

If a learner opts to take an HND from the start but later chooses to revert to an HNC programme, then on successful completion of the HNC they will receive a grade for the HNC achievement only.

Existing NQF Higher National units achievement can count towards the QCF Edexcel BTEC Higher Nationals.

Edexcel BTEC Higher Nationals within the QCF, NQF and FHEQ

QCF/NQF/ FHEQ level	Progression opportunities and examples of qualifications within each level
8	PhD/DPhil Professional doctorates (credit based), eg EdD
7	Master's degrees Postgraduate diplomas Postgraduate Certificate in Education (PGCE)
6	Bachelor's degrees, eg BA, BSc Professional Graduate Certificate in Education Graduate certificates and diplomas
5	**Edexcel BTEC HNDs** (Higher National Diplomas) Foundation Degrees, eg FdA, FdSc Diplomas of Higher Education (Dip HE)
4	**Edexcel BTEC HNCs** (Higher National Certificates) Certificates of Higher Education (Cert HE) Level 4 National Vocational Qualifications (NVQs)
3	Edexcel BTEC Level 3 Extended Diplomas Edexcel BTEC Level 3 Diplomas Edexcel BTEC Level 3 Subsidiary Diplomas Edexcel BTEC Level 3 Certificates GCE Advanced Level Level 3 NVQs Advanced Diplomas

UNITS
The units for the Edexcel BTEC Higher Nationals in Manufacturing Engineering are on the CD ROM that accompanies this specification and on the Edexcel website.

Contents

Qualification titles covered by this specification

Edexcel BTEC Level 4 HNC Diploma in Manufacturing Engineering (QCF)

Edexcel BTEC Level 5 HND Diploma in Manufacturing Engineering (QCF)

These qualifications have been accredited to the Qualifications and Credit Framework (QCF). The Qualification Numbers (QNs) for these qualifications are listed below.

These qualification titles are as they will appear on learners' certificates. Learners need to be made aware of this when they are recruited by the centre and registered with Edexcel. Providing this happens, centres are able to describe the programme of study leading to the award of the qualification in different ways to suit the medium and the target audience.

Centres are reminded that The Report of the National Committee of Inquiry into Higher Education (the Dearing Report) recommended that they *'develop, for each programme they offer, a 'programme specification' which identifies potential stopping-off points and gives the intended outcomes of the programme ...'*

The Quality Assurance Agency for Higher Education (QAA) has produced guidelines for centres in preparing programme specifications (reference *Guidelines for preparing programme specifications*: QAA 115 06/06) which includes related post-Dearing developments. Annexe 2: *Working with programme specifications: a leaflet for further education colleges* of this QAA document contains additional guidance notes to support further education colleges writing programme specifications for Edexcel awards.

Qualification Numbers

The Qualifications and Credit Framework (QCF) code is known as a Qualification Number (QN). Each unit within a qualification will also have a QCF unit code.

The QCF qualification and unit codes will appear on learners' final certification documentation.

The QNs for the qualifications in this publication are:

500/8829/4	Edexcel BTEC Level 4 HNC Diploma in Manufacturing Engineering (QCF)
500/8828/2	Edexcel BTEC Level 5 HND Diploma in Manufacturing Engineering (QCF)

Introduction

This specification contains the units and associated guidance for the QCF Edexcel BTEC Level 4 HNC in Manufacturing Engineering and the Edexcel BTEC Level 5 HND in Manufacturing Engineering.

Each unit sets out the required learning outcomes, assessment criteria and content and may also include advice regarding essential delivery and assessment strategies.

This document also contains details of the teaching, learning, assessment and quality assurance of these qualifications. It includes advice about Edexcel's policies regarding access to its qualifications, the design of programmes of study and delivery modes.

Structure of the qualification

Edexcel BTEC Level 4 HNC

The Edexcel BTEC Level 4 HNC in Manufacturing Engineering is a qualification with a minimum of 120 credits of which 50 are mandatory core.

The Edexcel BTEC Level 4 HNC programme must contain a minimum of 65 credits at level 4.

Edexcel BTEC Level 5 HND

The Edexcel BTEC Level 5 HND in Manufacturing Engineering is a qualification with a minimum of 240 credits of which 65 are mandatory core.

The Edexcel BTEC Level 5 HND programme must contain a minimum of 125 credits at level 5.

Rules of combination for Edexcel BTEC Levels 4 and 5 Higher National qualifications

The rules of combination specify the:

- total credit value of the qualification
- minimum credit to be achieved at the level of the qualification
- mandatory core unit credit
- specialist unit credit
- maximum credit that can be centre devised or imported from other QCF Edexcel BTEC Higher National qualifications.

When combining units for an Edexcel BTEC Higher National qualification it is the centre's responsibility to ensure that the following rules of combination are adhered to:

Edexcel BTEC Level 4 HNC in Manufacturing Engineering

1 Qualification credit value: a minimum of 120 credits. (A maximum of 55 credits may be at level 5.)

2 Minimum credit to be achieved at the level of the qualification (level 4): 65 credits.

3 Mandatory core unit credit: 50 credits.

4 Specialist unit credit: 70 credits.

5 A maximum of 30 credits can be centre devised or imported from other QCF Edexcel BTEC Higher National qualifications to meet local needs. Level rules and mandatory core units must not be changed.

Edexcel BTEC Level 5 HND in Manufacturing Engineering

1 Qualification credit value: a minimum of 240 credits. (A maximum of 30 credits may be at level 6.)

2 Minimum credit to be achieved at the level of the qualification (level 5): 125 credits.

3 Mandatory core unit credit: 65 credits.

4 Specialist unit credit: 175 credits.

5 The requirements of the HNC have to be met.

6 A maximum of 60 credits can be centre devised or imported from other QCF Edexcel BTEC Higher National qualifications to meet local needs. Level rules and mandatory core units must not be changed.

Structure of the Edexcel BTEC Level 4 HNC in Manufacturing Engineering

Unit number	Mandatory core units – all three units must be taken	Unit level	Unit credit
1	Analytical Methods for Engineers	4	15
2	Engineering Science	4	15
3	Project Design, Implementation and Evaluation	5	20
	Specialist units group A – choose units with a minimum credit value of 45 credits		
6	Health, Safety and Risk Assessment in Engineering	4	15
9	Manufacturing Planning and Scheduling Principles	5	15
10	Manufacturing Process	4	15
11	Supply Chain Management	4	15
12	Material Handling Systems	4	15
13	Application of Machine Tools	4	15
14	Computer-aided Machining	4	15
15	Design for Manufacture	5	15
16	Advanced Manufacturing Technologies	5	15
17	Business Improvement Techniques	5	15
18	Advanced Machine Tools	5	15
19	Computer-aided Design and Manufacture	5	15
20	Quality and Business Improvement	5	15
	Specialist units group B		
4	Mechanical Principles	5	15
5	Electrical and Electronic Principles	5	15
7	Business Management Techniques for Engineers	4	15
8	Engineering Design	5	15
21	Materials Engineering	4	15
22	Programmable Logic Controllers	4	15
23	Engineering Procurement	4	15
24	Applications of Pneumatics and Hydraulics	4	15
25	Engine and Vehicle Design and Performance	5	15
26	Employability Skills	5	15

Unit number	Specialist units group B *continued*	Unit level	Unit credit
27	Personal and Professional Development	5	15
28	Research Project	5	20
29	Work-based Experience	5	15
30	Quality Assurance and Management	5	15
31	Value Management	5	15
32	Industrial Robot Technology	5	15
33	Workplace Study and Ergonomics	5	15
34	Integrated Logistical Support Management	5	15
35	Further Analytical Methods for Engineers	5	15
36	Statistical Process Control	5	15
37	Management of Projects	4	15
38	Managing People in Engineering	5	15
57	Mechatronic Systems	4	15
59	Advanced Mathematics for Engineering	5	15
69	Advanced Computer-aided Design Techniques	4	15
76	Managing the Work of Individuals and Teams	5	15
100	Fabrication and Welding Processes in Manufacturing	4	15
101	Electrical and Electronic Principles	3	10
102	Mechanical Principles and Applications	3	10
103	Further Mathematics for Technicians	3	10
112	Computer Programming Techniques	4	15
115	Electronic Computer-Aided Design	4	15

The Edexcel BTEC Level 4 HNC programme must contain a minimum of 65 credits at level 4.

Structure of the Edexcel BTEC Level 5 HND in Manufacturing Engineering

Unit number	Mandatory core units – all four units must be taken	Unit level	Unit credit
1	Analytical Methods for Engineers	4	15
2	Engineering Science	4	15
3	Project Design, Implementation and Evaluation	5	20
9	Manufacturing Planning and Scheduling Principles	5	15
	Specialist units group A – choose units with a minimum credit value of 75 credits		
6	Health, Safety and Risk Assessment in Engineering	4	15
7	Business Management Techniques for Engineers	4	15
8	Engineering Design	5	15
10	Manufacturing Process	4	15
11	Supply Chain Management	4	15
12	Material Handling Systems	4	15
13	Application of Machine Tools	4	15
14	Computer-aided Machining	4	15
15	Design for Manufacture	5	15
16	Advanced Manufacturing Technologies	5	15
17	Business Improvement Techniques	5	15
18	Advanced Machine Tools	5	15
19	Computer-aided Design and Manufacture	5	15
20	Quality and Business Improvement	5	15
	Specialist units group B		
4	Mechanical Principles	5	15
5	Electrical and Electronic Principles	5	15
21	Materials Engineering	4	15
22	Programmable Logic Controllers	4	15
23	Engineering Procurement	4	15
24	Applications of Pneumatics and Hydraulics	4	15
25	Engine and Vehicle Design and Performance	5	15
26	Employability Skills	5	15
27	Personal and Professional Development	5	15

Unit number	Specialist units group B *continued*	Unit level	Unit credit
28	Research Project	5	20
29	Work-based Experience	5	15
30	Quality Assurance and Management	5	15
31	Value Management	5	15
32	Industrial Robot Technology	5	15
33	Workplace Study and Ergonomics	5	15
34	Integrated Logistical Support Management	5	15
35	Further Analytical Methods for Engineers	5	15
36	Statistical Process Control	5	15
37	Management of Projects	4	15
38	Managing People in Engineering	5	15
57	Mechatronic Systems	4	15
59	Advanced Mathematics for Engineering	5	15
69	Advanced Computer-aided Design Techniques	4	15
76	Managing the Work of Individuals and Teams	5	15
100	Fabrication and Welding Processes in Manufacturing	4	15
101	Electrical and Electronic Principles	3	10
102	Mechanical Principles and Applications	3	10
103	Further Mathematics for Technicians	3	10
112	Computer Programming Techniques	4	15
115	Electronic Computer-Aided Design	4	15

The Edexcel BTEC Level 5 HND programme must contain a minimum of 125 credits at level 5.

Key features

Edexcel BTEC Higher Nationals are designed to provide a specialist vocational programme, linked to professional body requirements and National Occupational Standards where appropriate.

They offer a strong, sector-related emphasis on practical skills development alongside the development of requisite knowledge and understanding.

The qualifications provide a thorough grounding in the key concepts and practical skills required in their sector and their national recognition by employers allows direct progression to employment.

A key progression path for Edexcel BTEC HNC/D learners is to the second or third year of a degree or honours degree programme, depending on the match of the BTEC Higher National units to the degree programme in question. Edexcel BTEC Higher Nationals in Manufacturing Engineering have been developed to focus on:

- the education and training of manufacturing engineers/technicians who are employed at a professional level in a variety of types of technical work, such as in: manufacturing systems design, manufacture, maintenance and technical services areas of the electronic, mechanical, automotive engineering industry
- providing opportunities for manufacturing engineers/technicians to achieve a nationally recognised level 4 or level 5 vocationally specific qualification
- providing opportunities for full-time learners to gain a nationally recognised vocationally specific qualification to enter employment as an engineer/technician or progress to higher education vocational qualifications such as a full- or part-time degree in manufacturing engineering
- providing opportunities for learners to focus on the development of the higher level skills in a technological and management context
- providing opportunities for learners to develop a range of skills and techniques and attributes essential for successful performance in working life.

This qualification meets the needs of the above rationale by:

- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life and thereby enabling learners to make an immediate contribution to employment at the appropriate professional level
- providing preparation for a range of technical and management careers in electronic, mechanical and automotive manufacturing engineering
- equipping individuals with knowledge, understanding and skills for success in employment in the electronic, mechanical, automotive manufacturing engineering-based industry
- providing specialist studies relevant to individual vocations and professions in which learners are working or intend to seek employment in electronic, mechanical, automotive manufacturing engineering and its related industries
- enabling progression to an undergraduate degree or further professional qualification in electronic, mechanical, automotive manufacturing engineering or related area
- providing a significant educational base for progression to Incorporated Engineer level.

Professional body recognition

The Edexcel BTEC Higher Nationals in Manufacturing Engineering have been developed with career progression and recognition by professional bodies in mind. It is essential that learners gain the maximum benefit from their programme of study.

The development of this qualification has been informed by discussions/relevant publications from the Engineering Council UK (EC (UK)), and the Science, Engineering and Manufacturing Technologies Alliance (SEMTA).

Further details of professional body recognition and exemptions for Edexcel BTEC Higher Nationals are given in the *BTEC Higher Nationals – Professional Recognition and Progression Directory 2008* available from our website: www.edexcel.com/quals/hn/Pages/Keydocuments.aspx.

National Occupational Standards

Edexcel BTEC Higher Nationals in Manufacturing Engineering are designed to relate to the National Occupational Standards in the manufacturing engineering sector at levels 4 and 5, which in turn form the basis of the manufacturing engineering National Vocational Qualifications (NVQs). Edexcel BTEC Higher Nationals do not purport to deliver occupational competence in the sector, which should be demonstrated in a work context. However, the qualifications provide underpinning knowledge for the National Occupational Standards, as well as developing practical skills in preparation for work and possible achievement of NVQs in due course.

Annexe B contains mapping of the Higher National units in this specification against relevant Level 4 NVQs where appropriate.

Qualification Requirement

Edexcel has published Qualification Requirements as part of the revision of Edexcel BTEC Higher Nationals. Qualification Requirements set out the aims and rationale of the qualifications and provide the framework of curriculum content. They also identify the higher-level skills associated with the qualifications and any recognition by relevant professional bodies. The Qualification Requirement for the Edexcel BTEC Higher Nationals in Manufacturing Engineering is given in *Annexe A*.

Edexcel standard specification titles are developed from the Qualification Requirements. Licensed centres comply with Qualification Requirements when developing Higher Nationals under these standard titles.

Qualification Requirements provide consistent standards within the same vocational area and identify the skills and knowledge that can be expected of any holder of an identical Edexcel BTEC Higher National. This will allow higher education institutions, employers and professional bodies to confidently provide progression opportunities to successful learners.

Higher-level skills

Learners studying for Edexcel BTEC Higher Nationals in Manufacturing Engineering will be expected to develop the following skills during the programme of study:

- analyse, synthesise and summarise information critically
- read and use appropriate literature with a full and critical understanding
- think independently, solve problems and devise innovative solutions
- take responsibility for their own learning and recognise their own learning style
- apply subject knowledge and understanding to address familiar and unfamiliar problems
- design, plan, conduct and report on investigations
- use their knowledge, understanding and skills to evaluate and formulate evidence-based arguments critically and identify solutions to clearly defined problems of a general routine nature
- communicate the results of their study and other work accurately and reliably using a range of specialist techniques
- identify and address their own major learning needs within defined contexts and to undertake guided further learning in new areas
- apply their subject-related and transferable skills in contexts where the scope of the task and the criteria for decisions are generally well defined but where some personal responsibility and initiative is required.

Edexcel BTEC Level 4 HNC

The Edexcel BTEC Level 4 HNC in Manufacturing Engineering provides a specialist work-related programme of study that covers the key knowledge, understanding and practical skills required in the manufacturing engineering sector and also offers particular specialist emphasis through the choice of specialist units.

Edexcel BTEC Level 4 HNCs provide a nationally recognised qualification offering career progression and professional development for those already in employment and opportunities to progress into higher education. The qualifications are mode free but they are primarily undertaken by part-time learners studying over two years. In some sectors there are opportunities for those wishing to complete an intensive programme of study in a shorter period of time.

This specification gives centres a framework to develop engaging programmes for higher education learners who are clear about the area of employment that they wish to enter.

The Edexcel BTEC Level 4 HNC in Manufacturing Engineering offers a progression route for learners who are employed in the manufacturing engineering sector.

Edexcel BTEC Level 5 HND

The Edexcel BTEC Level 5 HND provides greater breadth and specialisation than the Edexcel BTEC Level 4 HNC. Edexcel BTEC HNDs are mode free but are followed predominately by full-time learners. They allow progression into or within employment in the engineering sector, either directly on achievement of the award or following further study to degree level.

The Edexcel BTEC Level 5 HND in Manufacturing Engineering provides opportunities for learners to apply their knowledge and practical skills in the workplace. Full-time learners have the opportunity to do this through formal work placements or part-time employment experience.

The qualification prepares learners for employment in the manufacturing engineering sector and will be suitable for learners who have already decided that they wish to enter this area of work. Some adult learners may wish to make the commitment required by this qualification in order to enter a specialist area of employment in engineering or progress into higher education. Other learners may want to extend the specialism that they followed on the Edexcel BTEC Level 4 HNC programme.

Progression from this qualification may well be into or within employment in the manufacturing engineering sector where learners may work towards Incorporated Engineer status. Alternatively learners could progress to degree courses in related engineering areas such as manufacturing, electronics or automotive engineering.

Teaching, learning and assessment

Learners must achieve a minimum of 120 credits (of which at least 65 must be at level 4) on their programme of learning to be awarded an Edexcel BTEC Level 4 HNC and a minimum of 240 credits (of which at least 125 must be at level 5) to be awarded an Edexcel BTEC Level 5 HND.

The assessment of Edexcel BTEC Higher National qualifications is criterion-referenced and centres are required to assess learners' evidence against published learning outcomes and assessment criteria.

All units will be individually graded as 'pass', 'merit' or 'distinction'. To achieve a pass grade for the unit learners must meet the assessment criteria set out in the specifications. This gives transparency to the assessment process and provides for the establishment of national standards for each qualification.

The units in Edexcel BTEC Higher National qualifications all have a standard format which is designed to provide guidance on the requirements of the qualification for learners, assessors and those responsible for monitoring national standards.

Unit format

Each unit is set out in the following way.

Unit title, unit code, QCF level and credit value

The unit title is accredited on the QCF and this form of words will appear on the learner's Notification of Performance.

Each unit is assigned a level, indicating the relative intellectual demand, complexity and depth of study, and learner autonomy. All units and qualifications within the QCF will have a level assigned to them, which represents the level of achievement. There are nine levels of achievement, from Entry level to level 8. The level of the unit has been informed by the QCF level descriptors and, where appropriate, the National Occupational Standards (NOS) and/or other sector/professional benchmarks.

Each unit in Edexcel BTEC Higher National qualifications has a credit value which specifies the number of credits that will be awarded to a learner who has achieved all the learning outcomes of the unit. Learners will be awarded credits for the successful completion of whole units.

Aim

The aim provides a clear summary of the purpose of the unit and is a succinct statement that summarises the learning outcomes of the unit.

Unit abstract

The unit abstract gives the reader an appreciation of the unit in the vocational setting of the qualification, as well as highlighting the focus of the unit. It gives the reader a snapshot of the unit and the key knowledge, skills and understanding gained while studying the unit. The unit abstract also highlights any links to the appropriate vocational sector by describing how the unit relates to that sector.

Learning outcomes

The learning outcomes identify what each learner must do in order to pass the unit. Learning outcomes state exactly what a learner should 'know, understand or be able to do' as a result of completing the unit. Learners must achieve all the learning outcomes in order to pass the unit.

Unit content

The unit content identifies the breadth of knowledge, skills and understanding needed to design and deliver a programme of learning to achieve each of the learning outcomes. This is informed by the underpinning knowledge and understanding requirements of relevant National Occupational Standards (NOS) where appropriate.

Each learning outcome is stated in full and then the key phrases or concepts related to that learning outcome are listed in italics followed by the subsequent range of related topics.

The information below shows how unit content is structured and gives the terminology used to explain the different components within the content.

- Learning outcome: this is given in bold at the beginning of each section of content.
- Italicised sub-heading: it contains a key phrase or concept. This is content which must be covered in the delivery of the unit. Colons mark the end of an italicised sub-heading.
- Elements of content: the elements are in roman text and amplify the sub-heading. The elements must also be covered in the delivery of the unit. Semi-colons mark the end of an element.

- Brackets contain amplification of elements of content which must be covered in the delivery of the unit.
- 'eg' is a list of examples used for indicative amplification of an element (that is, the content specified in this amplification that could be covered or that could be replaced by other, similar material).

It is not a requirement of the unit specification that all of the content is assessed.

Learning outcomes and assessment criteria

Each unit contains statements of the evidence that each learner should produce in order to receive a pass.

Guidance

This section provides additional guidance and amplification related to the unit to support tutors/deliverers and assessors. Its subsections are given below.

- *Links* – sets out possible links between units within the specification. Provides opportunities for the integration of learning, delivery and assessment. Links to relevant National Occupational Standards and Professional Bodies Standards will be highlighted here.
- *Essential requirements* – essential, unique physical and/or staffing resources or delivery/assessment requirements needed for the delivery of this unit are specified here.
- *Employer engagement and vocational contexts* – this is an optional section. Where relevant it offers suggestions for employer contact to enhance the delivery of the unit.

These subsections should be read in conjunction with the learning outcomes, unit content, assessment criteria and the generic grade descriptors.

The centre will be asked to ensure that essential resources are in place when it seeks approval from Edexcel to offer the qualification.

Learning and assessment

The purpose of assessment is to ensure that effective learning of the content of each unit has taken place. Evidence of this learning, or the application of the learning, is required for each unit. The assessment of the evidence relates directly to the assessment criteria for each unit, supported by the generic grade descriptors.

The process of assessment can aid effective learning by seeking and interpreting evidence to decide the stage that learners have reached in their learning, what further learning needs to take place and how best to do this. Therefore, the process of assessment should be part of the effective planning of teaching and learning by providing opportunities for both the learner and assessor to obtain information about progress towards learning goals.

The assessor and learner must be actively engaged in promoting a common understanding of the assessment criteria and the grade descriptors (what it is they are trying to achieve and how well they achieve it) for further learning to take place. Therefore, learners need constructive feedback and guidance about how they may improve by capitalising on their strengths and clear and constructive comments about their weaknesses and how these might be addressed.

Assessment instruments are constructed within centres. They should collectively ensure coverage of all assessment criteria within each unit and should provide opportunities for the evidencing of all the grade descriptors.

It is advised that assessment criteria and contextualised grade descriptors are clearly indicated on each assessment instrument to provide a focus for learners (for transparency and to ensure that feedback is specific to the criteria) and to assist with internal standardisation processes. Tasks/activities should enable learners to produce evidence that relates directly to the assessment criteria and grade descriptors.

When centres are designing assessment instruments, they need to ensure that the instruments are valid, reliable and fit for purpose, building on the application of the assessment criteria. Centres are encouraged to place emphasis on practical application of the assessment criteria, providing a realistic scenario for learners to adopt, making maximum use of work-related practical experience and reflecting typical practice in the sector concerned. The creation of assessment instruments that are fit for purpose is vital to achievement and their importance cannot be over-emphasised.

Grading Higher National units

The grading of Edexcel BTEC Higher National qualifications is at the unit and the qualification level.

Each successfully completed unit will be graded as a pass, merit or distinction.

A pass is awarded for the achievement of all outcomes against the specified assessment criteria.

Merit and distinction grades are awarded for higher-level achievement. The generic merit and distinction grade descriptors listed in *Annexe C* are for grading the total evidence produced for each unit and describe the learner's performance over and above that for a pass grade. They can be achieved in a flexible way, for example in a sequential or holistic mode, to reflect the nature of the sector concerned.

Each of the generic merit and distinction grade descriptors can be amplified by use of **indicative characteristics**. These give a guide to the expected learner performance, and support the generic grade descriptors. The indicative characteristics should reflect the nature of a unit and the context of the sector programme.

The indicative characteristics shown in the table for each of the generic grade descriptors in *Annexe C* **are not exhaustive**. Consequently, centres should select appropriate characteristics from the list **or construct others** that are appropriate for their sector programme and level.

It is important to note that each assessment activity does not need to incorporate all the merit and/or distinction grade descriptors.

Contextualising the generic grade descriptors

The generic merit and distinction grade descriptors need to be viewed as a qualitative extension of the assessment criteria for pass within each individual unit. The relevant generic grade descriptors must be identified and specified within an assignment and the relevant indicative characteristics should be used to place the required evidence in context.

Summary of grades

In order to achieve a **pass** in a unit	• all learning outcomes and associated assessment criteria have been met
In order to achieve a **merit** in a unit	• pass requirements achieved • all merit grade descriptors achieved
In order to achieve a **distinction** in a unit	• pass and merit requirements achieved • all distinction grade descriptors achieved

Calculation of the qualification grade

Pass qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at pass grade (see section *Rules of combination for the Edexcel BTEC Levels 4 and 5 Higher National qualifications*).

Qualification grades above pass grade

Learners will be awarded a merit or distinction qualification grade by the aggregation of points gained through the successful achievement of individual units. **The graded section of both the HNC and the HND is based on the learner's best performance in units at the level or above of the qualification to the value of 75 credits.**

The number of points available is dependent on the unit grade achieved and the credit size of the unit (as shown in the 'Points available per credit at specified unit grades' table below).

Points available per credit at specified unit grades

Points per credit		
Pass	**Merit**	**Distinction**
0	1	2

Qualification grades

Edexcel BTEC Level 4 HNC

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

Edexcel BTEC Level 5 HND

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

Annexe E gives examples of how qualification grades are calculated.

The grade achieved in units from an appropriate HNC may contribute to an HND grade.

If a learner moves from HNC to HND then credits from both the HNC and HND can contribute to the best 75 credits of the overall HND grade.

Recognition of Prior Learning

Recognition of Prior Learning (RPL) is a method of assessment (leading to the award of credit) that considers whether a learner can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess and so do not need to develop through a course of learning.

Edexcel encourages centres to recognise learners' previous achievements and experiences whether at work, home and at leisure, as well as in the classroom. RPL provides a route for the recognition of the achievements resulting from continuous learning.

RPL enables recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable for accrediting a unit, units or a whole qualification. Evidence of learning must be valid and reliable.

For full guidance about Edexcel's policy on RPL please see our *Recognition of Prior Learning Policy* on our website. Please go to http://www.edexcel.com/Policies/Documents/Recognition of Prior Learning.pdf

Quality assurance of Edexcel BTEC Higher Nationals

Edexcel's quality assurance system for all BTEC higher level programmes on the QCF at Levels 4–7 will ensure that centres have effective quality assurance processes to review programme delivery. It will also ensure that the outcomes of assessment are to national standards.

The quality assurance process for centres offering Edexcel BTEC higher level programmes on the QCF at Levels 4–7 comprises three key components.

1) Approval process

Approval to offer Edexcel BTEC Higher National qualifications will vary depending on the status of the centre.

Centres that have a recent history of delivering Edexcel BTEC Higher National qualifications and have an acceptable quality profile in relation to their delivery will be able to gain approval through Edexcel Online.

Centres new to the delivery of Edexcel BTEC Higher National qualifications will be required to seek approval through the existing Edexcel qualification and centre approval process. Prior to approval being given, centres will be required to submit evidence to demonstrate that they:

- have the human and physical resources required for effective delivery and assessment
- understand the implications for independent assessment and agree to abide by these
- have a robust internal assessment system supported by 'fit for purpose' assessment documentation
- have a system to internally verify assessment decisions, to ensure standardised assessment decisions are made across all assessors and sites.

Such applications have to be supported by the head of the centre (principal, chief executive etc). and include a declaration that the centre will operate the programmes strictly as approved and in line with Edexcel requirements.

2) Monitoring of internal centre systems

Centres will be required to demonstrate ongoing fulfilment of the centre approval criteria over time and across all programmes. The process that assures this is external examination, which is undertaken by Edexcel's External Examiners. Centres will be given the opportunity to present evidence of the ongoing suitability and deployment of their systems to carry out the required functions. This includes the consistent application of policies affecting learner registrations, appeals, effective internal examination and standardisation processes. Where appropriate, centres may present evidence of their operation within a recognised code of practice, such as that of the Quality Assurance Agency for Higher Education. Edexcel reserves the right to confirm independently that these arrangements are operating to Edexcel's satisfaction.

Edexcel will affirm, or not, the ongoing effectiveness of such systems. Where system failures are identified, sanctions (appropriate to the nature of the problem) will be applied in order to assist the centre in correcting the problem.

3) Independent assessment review

The internal assessment outcomes reached for all Edexcel BTEC higher level programmes on the Qualifications and Credit Framework at Levels 4-7 are subject to an independent assessment review by an Edexcel-appointed External Examiner.

The outcomes of this process will be to:

- confirm that internal assessment is to national standards and allow certification

or

- make recommendations to improve the quality of assessment outcomes before certification is released

or

- make recommendations about the centre's ability to continue to be approved for the qualifications in question.

Additional arrangement for ALL centres

Regardless of the type of centre, Edexcel reserves the right to withdraw either qualification or centre approval when it deems there is an irreversible breakdown in the centre's ability either to quality assure its programme delivery or its assessment standards.

Programme design and delivery

Edexcel BTEC Higher National qualifications consist of mandatory core units and specialist units. The specialist units are designed to provide a specific focus to the qualification. Required combinations of specialist units are clearly set out in relation to each qualification in the defined qualification structures provided in this document.

In Edexcel BTEC Higher National qualifications each unit's credit value usually consists of multiples of 5 credits. Most units are 15 credits in value. These units have been designed from a learning time perspective. **Each 15-credit unit approximates to a learning time of 150 hours**.

These new Edexcel BTEC Level 5 HND qualifications are the same size as the Edexcel Level 5 BTEC Higher National Diplomas which were accredited onto the National Qualifications Framework (NQF). Therefore, it is expected that these Edexcel BTEC Level 5 HNDs, accredited onto the Qualifications and Credit Framework (QCF), will also require approximately 960 guided learning hours (GLH).

Consequently, using the above approach, the new Edexcel BTEC Level 4 HNCs, which are accredited onto the QCF, and are now half the size of the Edexcel BTEC Level 5 Higher National Diplomas, will require approximately 480 GLH.

Within the information relating to these units on the QCF, each 15-credit unit has been allocated a figure of 60 GLH to help guide centres (other units with smaller or larger credit values have figures calculated on a pro rata basis). Centres delivering these qualifications are required to use their professional expertise in the design and delivery of these qualifications within the overall guided learning hours for the qualification.

Guided learning hours are defined as all the time when a tutor, trainer or facilitator is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops. It also includes time spent by staff assessing learners' achievements. It does not include time spent by staff in day-to-day marking of assignments where the learner is not present.

Learning time is defined as the time taken by learners at the level of the unit, on average, to complete the learning outcomes of the unit to the standard determined by the assessment criteria. It should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Centres are advised to consider this definition when planning the programme of study associated with this specification.

Annexe D provides information for centres and learners who wish to compare, for teaching and learning purposes, the units of the NQF Edexcel Level 5 BTEC Higher Nationals in Manufacturing Engineering with the new units of the QCF Edexcel BTEC Higher Nationals in Manufacturing Engineering.

Mode of delivery

Edexcel does not define the mode of study for Edexcel BTEC Higher National qualifications. Centres are free to offer the qualification(s) using any mode of delivery that meets the needs of their learners. This may be through traditional classroom teaching, open learning, distance learning or a combination of these. Whatever mode of delivery is used, centres must ensure that learners have appropriate access to the resources identified in the specification and to the subject specialists delivering the units. This is particularly important for learners studying for the qualification through open or distance learning.

Full guidance on our policies on 'distance assessment' and 'electronic assessment' are given on our website.

Learners studying for the qualification on a part-time basis bring with them a wealth of experience that should be utilised to maximum effect by tutors and assessors. Assessment instruments based on learners' work environments should be encouraged. Those planning the programme should aim to enhance the vocational nature of the Edexcel BTEC Higher National qualification by:

- liaising with employers to ensure that the course is relevant to learners' specific needs
- accessing and using non-confidential data and documents from learners' workplaces
- including sponsoring employers in the delivery of the programme and, where appropriate, in the assessment
- linking with company-based/workplace training programmes
- making full use of the variety of experiences of work and life that learners bring to the programme.

Resources

Edexcel BTEC Higher National qualifications are designed to prepare learners for employment in specific industry sectors.

Physical resources need to support the delivery of the programme and the proper assessment of the outcomes and, therefore, should normally be of industry standard.

Staff delivering programmes and conducting the assessments should be familiar with current practice, legislation and standards used in the sector concerned.

Centres will need to meet any specialist resource requirements when they seek approval from Edexcel.

Please refer to the *Essential requirements* section in individual units for specialist resource requirements.

Delivery approach

It is important that centres develop an approach to teaching and learning that supports the specialist vocational nature of the Edexcel BTEC Higher National qualification. Specifications contain a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature. Tutors and assessors need to ensure that appropriate links are made between theory and practice and that the knowledge base is applied to the sector. This will require the development of relevant and up-to-date teaching materials that allow learners to apply their learning to actual events and activities within the sector. Maximum use should be made of the learner's experience.

Meeting local needs

Centres should note that the qualifications set out in these specifications have been developed in consultation with centres, employers and the Engineering Council UK, the professional body for the engineering sector, together with support from an appropriate Sector Skills Council (SSC), Sector Skills Body (SSB) or National Training Organisation (NTO) for the engineering sector.

The units are designed to meet the skill needs of the sector and the specialist units allow coverage of the full range of employment within the sector. Centres should make maximum use of the choice available to them within the specialist units to meet the needs of their learners, as well as the local skills and training needs identified by organisations such as Regional Development Agencies and local funding agencies.

Centres may not always be able to meet local needs using the units in this specification. In this situation, centres can seek approval from Edexcel to use units from other Edexcel BTEC Higher National qualifications on the QCF. Centres will need to justify the need for importing units from other specifications and Edexcel will ensure that the vocational focus of the qualification remains the same.

Locally-devised specialist units

There may be exceptional circumstances where even the flexibility of importing units from other specifications does not meet a particular local need. In this case, centres can seek permission from Edexcel to develop a unit(s) with us to meet this need. Permission will be granted only in a limited number of cases.

Edexcel will ensure that the integrity of the qualification is not compromised and that there is a minimum of overlap and duplication of content of existing units. Centres will need strong evidence of the local need and the reasons why the existing standard units are inappropriate. Edexcel will validate these units.

Limitations on variations from standard specifications

The flexibility to import standard units from other QCF Edexcel BTEC Higher National specifications and/or to develop unique locally-devised specialist units is **limited to a maximum of 30 credits in an Edexcel BTEC HNC qualification and a maximum of 60 credits only in any Edexcel BTEC HND qualification**. These units cannot be used at the expense of the mandatory core units in any qualification nor can the qualification rules of combination level rules be compromised.

Access and recruitment

Edexcel's policy regarding access to our qualifications is that:

- qualifications should be available to everyone who is capable of reaching the required standards
- qualifications should be free from any barriers that restrict access and progression
- there must be equal opportunities for everyone wishing to access the qualification.

Centres are required to recruit learners to Edexcel BTEC Higher National qualifications with integrity. This will include ensuring that applicants have appropriate information and advice about the qualifications and that the qualification will meet their needs. Centres should take appropriate steps to assess each applicant's potential and make a professional judgement about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should also show regard for Edexcel's policy (see our website) on learners with particular requirements.

Centres will need to review the profile of qualifications and/or experience held by applicants, considering whether this profile shows an ability to progress to level 4 or level 5 qualifications. For learners who have recently been in education, the entry profile is likely to include one of the following:

- a BTEC Level 3 qualification in engineering
- a GCE Advanced level profile which demonstrates strong performance in a relevant subject or an adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at A* to C
- other related level 3 qualifications
- an Access to Higher Education Certificate awarded by an approved further education institution
- related work experience.

Mature learners may present a more varied profile of achievement that is likely to include extensive work experience (paid and/or unpaid) and/or achievement of a range of professional qualifications in their work sector.

Restrictions on learner entry

The Edexcel BTEC Higher National qualifications are accredited on the QCF for learners aged 18 years and over.

Access arrangements and special considerations

Edexcel's policy on access arrangements and special considerations for BTEC and Edexcel NVQ qualifications aims to enhance access to the qualifications for learners with disabilities and other difficulties (as defined by the Disability Discrimination Act 1995 and the amendments to the Act) without compromising the assessment of skills, knowledge, understanding or competence.

Further details are given on our website (www.edexcel.com).

Useful publications

Further copies of this document and related publications can be obtained from:

Edexcel Publications
Adamsway
Mansfield
Nottinghamshire NG18 4FN

Telephone: 01623 467 467
Fax: 01623 450 481
Email: publication.orders@edexcel.com

Related publications include:

- the current Edexcel publications catalogue and update catalogue
- Edexcel publications concerning the quality assurance system and the internal and external verification of vocationally-related programmes may be found on the Edexcel website and in the Edexcel publications catalogue.

NB: Most of our publications are priced. There is also a charge for postage and packing. Please check the cost when you order.

Professional body contact details

The Engineering Council is the regulatory body for the engineering profession in the UK.

Engineering Council
246 High Holborn
London WC1V 7EX

Website: www.engc.org.uk

How to obtain National Occupational Standards

The National Occupational Standards for Engineering Management and Business Improvement Techniques can be obtained from:

SEMTA
14 Upton Road
Watford WD18 0JT

Telephone: 01923 238441
Website: www.semta.org.uk

Professional development and training

Edexcel supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered in our published training directory or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing student-centred learning and teaching approaches
- building key skills into your programme
- building in effective and efficient quality assurance systems.

The national programme of training we offer can be viewed on our website (www.edexcel.com/training). You can request customised training through the website or by contacting one of our advisers in the Training from Edexcel team via Customer Services to discuss your training needs.

Our customer service numbers are:

BTEC and NVQ	0844 576 0026
GCSE	0844 576 0027
GCE	0844 576 0025
The Diploma	0844 576 0028
DiDA and other qualifications	0844 576 0031

Calls may be recorded for training purposes.

The training we provide:

- is active – ideas are developed and applied
- is designed to be supportive and thought provoking
- builds on best practice.

Our training is underpinned by the former LLUK standards for those preparing to teach and for those seeking evidence for their continuing professional development.

Further information

For further information please call Customer Services on 0844 576 0026 (calls may be recorded for training purposes) or visit our website at www.edexcel.com.

Annexe A

Qualification Requirement

BTEC Higher Nationals in Manufacturing Engineering

This qualification requirement will be read in conjunction with overarching guidance from Edexcel.

Rationale

The BTEC Higher Nationals in Manufacturing Engineering have been developed to focus on:

- the education and training of manufacturing engineers/technicians who are employed at a professional level in a variety of types of technical work, such as in: manufacturing systems design, manufacture, maintenance and technical services areas of the electronic, mechanical and automotive engineering industries
- providing opportunities for manufacturing engineers/technicians to achieve a nationally recognised Level 4 or Level 5 vocationally specific qualification
- providing opportunities for full-time learners to gain a nationally recognised vocationally specific qualification to enter employment as an engineer/technician or progress to higher education vocational qualifications such as a full or part-time degree in manufacturing engineering
- providing opportunities for learners to focus on the development of the higher level skills in a technological and management context
- providing opportunities for learners to develop a range of skills and techniques and attributes essential for successful performance in working life.

Aims of the qualification

These qualifications meet the needs of the above rationale by:

- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life and thereby enable learners to make an immediate contribution to employment at the appropriate professional level
- to provide preparation for a range of technical and management careers in electronic, mechanical and automotive manufacturing engineering
- equipping individuals with knowledge, understanding and skills for success in employment in the electronic, mechanical, automotive manufacturing engineering -based industry
- providing specialist studies relevant to individual vocations and professions in which students are working or intend to seek employment in electronic, mechanical, automotive manufacturing engineering and its related industries
- enabling progression to an undergraduate degree or further professional qualification in electronic, mechanical, automotive manufacturing engineering or related area
- providing a significant basis for progression to Incorporated Engineer level.

Mandatory curriculum

The mandatory curriculum will give learners the opportunity to build on previous attainment while allowing them to progress and study a selection of optional curriculum. It will display the following features:

- a knowledge and use of essential scientific principles to produce routine solutions to familiar manufacturing engineering problems and using this knowledge to model and analyse routine manufacturing engineering systems, processes and products
- major manufacturing scientific principles which underpin the design and operation of static and dynamic engineering systems and provide an overview as the basis for further study in specialist areas of manufacturing engineering
- an extended range of principles for more advanced study and which underpin the design and operation of manufacturing engineering systems in planning and scheduling
- use of skills and knowledge developed during the course to select a project and agree specifications, implement and evaluate the project and present the project evaluation
- obtaining accurate information on the requirements for an individual or group engineering project
- project work that is of a technical nature and supportive of engineering orientation of the Manufacturing Engineering Higher National programme, in particular integrated exercises involving a technical investigation, which incorporates a financial appreciation
- fundamental analytical knowledge and techniques used for analysis, modelling and solution of realistic engineering problems within manufacturing engineering
- a knowledge of routine mathematical methods essential to manufacturing engineering including an awareness of the functionality of standard methods.

Optional curriculum

The optional curriculum will give learners the opportunity to select relevant specialism while allowing them to build on learning within the mandatory curriculum. It will display the following features:

- applying an understanding of mathematics, science, information technology, design, business and engineering practice to solve routine problems
- the engineering principles which underpin the application of manufacturing processes with particular emphasis on machine tools
- knowledge of the calculation of costs associated with engineered products and services
- a knowledge of the principles underpinning manufacturing using computer numeric control (CNC)
- the properties, selection, processing and use of materials
- an extended range of knowledge and understanding of the concepts and practices of producing electronic products using microelectronic devices and their application in printed circuit boards
- an awareness of the principles of health and safety planning and implementation in a manufacturing engineering environment
- using number systems, graphical and numerical methods, vectors, matrices and ordinary differential equations to analyse, model and solve realistic engineering problems

- use of advanced computer-aided design techniques including surface model and solid model generation techniques
- a broad and in-depth knowledge of a range of manufacturing processes and techniques including CAM which can be applied across a variety of materials and applications considering function, purpose and economic evaluation of different manufacturing technologies and strategies
- an introduction to programmable logic controller concepts and their applications in engineering and robot technology
- a basic knowledge of skills commonly used in the management of modern material handling systems, logistics and strategies for controlling material flows, inventory and purchasing
- a broad understanding of resource management and procurement strategy
- a detailed understanding of the supply chain and all activities associated with its planning, operation and improvement
- the development of knowledge to manage an integrated logistic support programme and the techniques to monitor such a programme
- an understanding of the issues involved in managing the work of individuals and teams employed in the manufacturing engineering industry including industrial relations and legislation and identification of common industrial engineering tasks such as productivity, work study, ergonomics and layout design
- application of relevant statistical techniques and other quality assurance and management principles
- experience of detailed design for economic manufacture including electronic computer-aided design
- investigating the principles involved in semiconductor manufacture and the development of principles to understand the fundamental processes involved in the operation of semiconductor processing equipment, and concepts and practices of producing electronic products using microelectronic devices and their application in printed circuit boards
- an awareness of the principles of health and safety planning and implementation in a electrical/electronic engineering environment
- an extended range of electrical/electronic principles for more advanced study and which underpin the design and operation of electrical/electronic engineering systems including circuit and networks
- an extended range of mechanical principles which underpin the design and operation of mechanical engineering systems including strengths of materials and mechanics of machines
- applying principles of measurement and testing in determining the performance of a vehicle system
- an understanding of principles associated with vehicle engineering design such as engine design and performance and vehicle design and performance
- applying continuous improvement techniques and principles of effective workplace organisation and culture
- an appreciation of lean manufacturing techniques such as lead time analysis, set up reduction and total productive maintenance and other value management activities
- the use and application of quality techniques associated with business improvement such as potential failure modes and effects analysis (FMEA), six sigma metrics and quality function deployment (QFD).

Professional body recognition

The BTEC Higher National qualifications in Manufacturing Engineering have been developed with career progression and recognition by professional bodies in mind. It is essential that learners gain the maximum benefit from their programme of study. Thus this development has been informed by discussions/relevant publications from the Engineering Council UK (EC (UK)), and the Science, Engineering and Manufacturing Technologies Alliance (SEMTA).

Entry prerequisites

The fundamental principles of Edexcel's policy are:

- qualifications should be available to everyone who is capable of reaching the required standards
- qualifications should be free from barriers which restrict access and progression
- equal opportunities exist for all.

Nevertheless it is the responsibility of the centre to recruit with integrity. Centres should therefore:

- provide applicants with appropriate information and advice
- identify applicants' needs
- select on the basis of each applicant's previous qualifications and experience.

Edexcel BTEC Higher National programmes are intended primarily for those who are in, or plan to enter, employment and who have reached the minimum age of 18. Students who enter with at least one of the following qualifications are likely to benefit more readily from the programme:

- a BTEC National Certificate or Diploma in an engineering discipline
- a GCE Advanced level profile which demonstrates strong performance in a relevant subject or an adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at A* to C.

Higher-level skills and abilities

Learners will be expected to develop the following skills during the programme of study:

- analysing, synthesising and summarising information critically
- the ability to read and use appropriate literature with a full and critical understanding
- the ability to think independently and solve problems
- the ability to take responsibility for their own learning and recognise their own learning style
- obtaining and integrating several lines of subject-specific evidence to formulate and test hypotheses
- applying subject knowledge and understanding to address familiar and unfamiliar problems
- recognising the moral and ethical issues of scientific enquiry and experimentation and appreciating the need for ethical standards and professional codes of conduct
- designing, planning, conducting and reporting on investigations

- use their knowledge, understanding and skills to evaluate and formulate evidence-based arguments critically and identify solutions to clearly defined problems of a general routine nature
- communicate the results of their study and other work accurately and reliably using a range of specialist techniques
- identify and address their own major learning needs within defined contexts and to undertake guided further learning in new areas
- apply their subject-related and transferable skills in contexts where the scope of the task and the criteria for decisions are generally well defined but where some personal responsibility and initiative is required.

Annexe B

National Occupational Standards

Mapping against the level 4 NVQ in Engineering Management and level 4 NVQ in Business Improvement Techniques

The grid below maps the knowledge covered in the level 4 NVQ in Engineering Management and the level 4 NVQ in Business Improvement Techniques against the underpinning knowledge of the QCF Edexcel BTEC Higher Nationals in Manufacturing Engineering.

KEY

Relevant NVQ units are listed where the BTEC unit provides partial coverage of the underpinning knowledge and understanding.

A blank space indicates no coverage of the underpinning knowledge.

	BTEC HN unit														
NVQ	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**	**Unit 11**	**Unit 12**	**Unit 13**	**Unit 14**	**Unit 15**
Level 4 NVQ in Engineering Management						Unit 4.01		Units 4.12, 4.13	Unit 4.16						Unit 4.12

	BTEC HN unit														
NVQ	**Unit 16**	**Unit 17**	**Unit 18**	**Unit 19**	**Unit 20**	**Unit 21**	**Unit 22**	**Unit 23**	**Unit 24**	**Unit 25**	**Unit 26**	**Unit 27**	**Unit 28**	**Unit 29**	**Unit 30**
Level 4 NVQ in Engineering Management								Unit 4.17					Units 4.5, 4.6, 4.8, 4.9		Unit 4.29
Level 4 NVQ in Business Improvement Techniques		Units 8, 11, 12, 36			Units 5 and 21										

	BTEC HN unit														
NVQ	**Unit 31**	**Unit 32**	**Unit 33**	**Unit 34**	**Unit 35**	**Unit 36**	**Unit 37**	**Unit 38**	**Unit 57**	**Unit 59**	**Unit 69**	**Unit 76**	**Unit 101**	**Unit 102**	**Unit 103**
Level 4 NVQ in Engineering Management															
Level 4 NVQ in Business Improvement Techniques	Unit 17					Unit 14									

Annexe C

Grade descriptors

Pass grade

A **pass grade** is achieved by meeting all the requirements defined in the assessment criteria for pass for each unit.

Merit grade

Merit descriptors	**Exemplar indicative characteristics** **Centres can identify and use other relevant characteristics. This is NOT a tick list.**
In order to achieve a **merit** the learner must:	The learner's evidence shows, for example:
• identify and apply strategies to find appropriate solutions	• effective judgements have been made • complex problems with more than one variable have been explored • an effective approach to study and research has been applied
• select/design and apply appropriate methods/techniques	• relevant theories and techniques have been applied • a range of methods and techniques have been applied • a range of sources of information has been used • the selection of methods and techniques/sources has been justified • the design of methods/techniques has been justified • complex information/data has been synthesised and processed • appropriate learning methods/techniques have been applied
• present and communicate appropriate findings	• the appropriate structure and approach has been used • coherent, logical development of principles/concepts for the intended audience • a range of methods of presentation have been used and technical language has been accurately used • communication has taken place in familiar and unfamiliar contexts • the communication is appropriate for familiar and unfamiliar audiences and appropriate media have been used.

Distinction grade

Distinction descriptors	Exemplar indicative characteristics **Centres can identify and use other relevant characteristics. This is NOT a tick list.**
In order to achieve a **distinction** the learner must:	The learner's evidence shows, for example:
• use critical reflection to evaluate own work and justify valid conclusions	• conclusions have been arrived at through synthesis of ideas and have been justified • the validity of results has been evaluated using defined criteria • self-criticism of approach has taken place • realistic improvements have been proposed against defined characteristics for success
• take responsibility for managing and organising activities	• autonomy/independence has been demonstrated • substantial activities, projects or investigations have been planned, managed and organised • activities have been managed • the unforeseen has been accommodated • the importance of interdependence has been recognised and achieved
• demonstrate convergent/lateral/ creative thinking	• ideas have been generated and decisions taken • self-evaluation has taken place • convergent and lateral thinking have been applied • problems have been solved • innovation and creative thought have been applied • receptiveness to new ideas is evident • effective thinking has taken place in unfamiliar contexts.

Annexe D

Unit mapping overview

New QCF versions of the Edexcel BTEC Higher National units in Manufacturing Engineering (specification start date 01/09/2010) mapped against the NQF BTEC Higher National units in Manufacturing Engineering (specification end date 31/12/2010).

Unit number	QCF unit title	Maps to NQF unit number	Level of similarity between units
1	Analytical Methods for Engineers	2	F
2	Engineering Science	3	F
3	Project Design, Implementation and Evaluation	5	F
4	Mechanical Principles	17	F
5	Electrical and Electronic Principles	40	F
6	Health, Safety and Risk Assessment in Engineering	7	F
7	Business Management for Engineers	1	F
8	Engineering Design	4	F
9	Manufacturing Planning and Scheduling Principles	6	F
10	Manufacturing Process	8	F
11	Supply Chain Management	21	F
12	Material Handling Systems	23	F
13	Application of Machine Tools	9	F
14	Computer-aided Machining	14	F
15	Design for Manufacture	15	F
16	Advanced Manufacturing Technologies	12	F
17	Business Improvement Techniques	26	F
18	Advanced Machine Tools	10	F
19	Computer-aided Design and Manufacture	13	F
20	Quality and Business Improvement	25	F
21	Materials Engineering	16	F

Unit number	QCF unit title	Maps to NQF unit number	Level of similarity between units
22	Programmable Logic Controllers	32	F
23	Engineering Procurement	20	F
24	Applications of Pneumatics and Hydraulics	N/A	N
25	Engine and Vehicle Design and Performance	43	F
26	Employability Skills	N/A	N
27	Personal and Professional Development	N/A	N
28	Research Project	N/A	N
29	Work-based Experience	N/A	N
30	Quality Assurance and Management	24	F
31	Value Management	27	F
32	Industrial Robot Technology	33	F
33	Workplace Study and Ergonomics	19	F
34	Integrated Logistical Support Management	22	F
35	Further Analytical Methods for Engineers	18	F
36	Statistical Process Control	31	F
37	Management of Projects	30	F
38	Managing People in Engineering	29	F
57	Mechatronic Systems	47	P
59	Advanced Mathematics for Engineering	N/A	N
69	Advanced Computer-aided Design Techniques	11	F
76	Managing the Work of Individuals and Teams	28	F
101	Electrical and Electronic Principles	N/A	N
102	Mechanical Principles and Applications	N/A	N
103	Further Mathematics for Engineering Technicians	N/A	N

KEY

P – Partial mapping (some topics from the old unit appear in the new unit)

F – Full mapping (topics in old unit match new unit exactly or almost exactly)

X – Full mapping + new (all the topics from the old unit appear in the new unit, but new unit also contains new topic(s))

N – New unit

Unit mapping in depth

New QCF versions of the Edexcel BTEC Higher National units in Manufacturing Engineering (specification start date 01/09/2010) mapped against the NQF BTEC Higher National units in Manufacturing Engineering (specification end date 31/12/2010).

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
1	Analytical Methods for Engineers	2	Analytical Methods for Engineers	Full mapping
2	Engineering Science	3	Engineering Science	Full mapping
3	Project Design, Implementation and Evaluation	5	Project	Full mapping
4	Mechanical Principles	17	Mechanical Principles	Full mapping
5	Electrical and Electronic Principles	40	Electrical and Electronic Principles	Full mapping
6	Health, Safety and Risk Assessment in Engineering	7	Health, Safety and Risk Assessment	Full mapping
7	Business Management for Engineers	1	Business Management for Engineers	Full mapping
8	Engineering Design	4	Engineering Design	Full mapping
9	Manufacturing Planning and Scheduling Principles	6	Planning and Scheduling Principles	Full mapping
10	Manufacturing Process	8	Manufacturing Process	Full mapping
11	Supply Chain Management	21	Supply Chain Management	Full mapping
12	Material Handling Systems	23	Materials Handling	Full mapping
13	Application of Machine Tools	9	Application of Machine Tools	Full mapping

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
14	Computer-aided Machining	14	Computer-aided Machining	Full mapping
15	Design for Manufacture	15	Design for Manufacture	Full mapping
16	Advanced Manufacturing Technologies	12	Advanced Manufacturing Technologies	Full mapping
17	Business Improvement Techniques	26	Further Business Improvement Techniques	Full mapping
18	Advanced Machine Tools	10	Advanced Machine Tools	Full mapping
19	Computer-aided Design and Manufacture	13	Computer-aided Design and Manufacture	Full mapping
20	Quality and Business Improvement	25	Quality and Business Improvement	Full mapping
21	Materials Engineering	16	Materials Engineering	Full mapping
22	Programmable Logic Controllers	32	Programmable Logic Controllers	Full mapping
23	Engineering Procurement	20	Engineering Procurement	Full mapping
24	Applications of Pneumatics and Hydraulics			New Unit
25	Engine and Vehicle Design and Performance	43	Vehicle Engineering Principles	Full mapping
26	Employability Skills			New Unit
27	Personal and Professional Development			New Unit
28	Research Project			New Unit
29	Work-based Experience			New Unit
30	Quality Assurance and Management	24	Quality Assurance and Management	Full mapping

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
31	Value Management	27	Value Management	Full mapping
32	Industrial Robot Technology	33	Industrial Robot Technology	Full mapping
33	Workplace Study and Ergonomics	19	Industrial Engineering	Full mapping
34	Integrated Logistical Support Management	22	Integrated Logistical Support Management	Full mapping
35	Further Analytical Methods for Engineers	18	Further Analytical Methods for Engineers	Full mapping
36	Statistical Process Control	31	Statistical Process Control	Full mapping
37	Management of Projects	30	Management of Projects	Full mapping
38	Managing People in Engineering	29	Managing People in Engineering	Full mapping
57	Mechatronic Systems	47	Mechatronic Systems Principles	Full mapping for learning outcomes 1 and 3. *Electro-mechanical models and components* and *mechatronic design philosophies* now included
59	Advanced Mathematics for Engineering			New unit
69	Advanced Computer-aided Design Techniques	11	Advanced Computer-aided Design Techniques	Full mapping
76	Managing the Work of Individuals and Teams	28	Managing the Work of Individuals and Teams	Full mapping
101	Electrical and Electronic Principles			New unit
102	Mechanical Principles and Applications			New unit
103	Further Mathematics for Engineering Technicians			New unit

Annexe E

Calculation of the qualification grade

Pass qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at pass grade (see section *Rules of combination for the Edexcel BTEC Levels 4 and 5 Higher National qualifications*).

Qualification grades above pass grade

Learners will be awarded a merit or distinction qualification grade by the aggregation of points gained through the successful achievement of individual units. **The graded section of both qualifications is based on the learner's best performance in units at the level or above of the qualification to the value of 75 credits.**

The number of points available is dependent on the unit grade achieved and the credit size of the unit (as shown in the 'Points available per credit at specified unit grades' table below).

Points available per credit at specified unit grades

Points per credit		
Pass	**Merit**	**Distinction**
0	1	2

Qualification grades

Edexcel BTEC Level 4 HNC

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

Edexcel BTEC Level 5 HND

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

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Examples of possible learner profiles of the best 75 credits at the level of the qualification or above. These tables fit both HNC and HND qualifications.

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	30	0	0
Merit	30	1	30
Distinction	15	2	30
		Total	**60**
		Qualification grade	**Pass**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	15	0	0
Merit	45	1	45
Distinction	15	2	30
		Total	**75**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	30	0	0
Merit	15	1	15
Distinction	30	2	60
		Total	**75**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	0	0	0
Merit	15	1	15
Distinction	60	2	120
		Total	**135**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	0	0	0
Merit	0	1	0
Distinction	75	2	150
		Total	**150**
		Qualification grade	**Distinction**

MANUFACTURING ENGINEERING
Specification

LEVEL 4 HNC
LEVEL 5 HND

Our most advanced specification to date

This new BTEC Higher Nationals specification has been completely revised and updated to bring it into line with the requirements of the Qualifications and Credit Framework (QCF), which comes into force from September 2010. All the units and qualifications covered in the specification have been reviewed by industry representatives and approved by the relevant Sector Skills Council. This means they are recognised as fit for purpose as high level vocational and work-related qualifications.

Each unit in the new specification is allocated a level and a credit value. Each unit in the specification has clearly stated learning outcomes and assessment criteria, so it is clear from the outset what learners must be able to do to achieve the unit.

BTEC Qualifications covered by this specification:

- Edexcel BTEC Level 4 HNC Diploma in Manufacturing Engineering
- Edexcel BTEC Level 5 HND Diploma in Manufacturing Engineering

A copy of this specification can be found online at:
www.btec.co.uk

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Acknowledgements

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References

References in this guide to third-party materials are made in good faith. Edexcel does not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein.

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