

**Pearson  
BTEC Level 4  
Higher National Certificate  
in Operations Engineering**

**Pearson  
BTEC Level 5  
Higher National Diploma  
in Operations Engineering**

**Specification**

BTEC Higher Nationals

First teaching June 2014

Issue 7

## **Edexcel, BTEC and LCCI qualifications**

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**This specification is Issue 7.** Due to the replacement of the Qualifications and Credit Framework by the Regulated Qualifications Framework (RQF), references to the QCF and to its predecessor, the National Qualifications Framework (NQF) have been removed from this specification. In addition, Pearson has assigned Total Qualification Time (TQT) in hours to this qualification; this is covered in the section entitled '*Programme design and delivery*' of this specification.

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## **Pearson BTEC Level 4 HNC Diploma in Operations Engineering**

## **Pearson BTEC Level 5 HND Diploma in Operations Engineering**

The BTEC HNCs (Higher National Certificates) are at level 4 and are a minimum of 120 credits in size. They have been nested within the structures of the BTEC HNDs (Higher National Diplomas).

The BTEC HNDs are 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 the BTEC Higher Nationals continues to be from level 3 qualifications and progression from the 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 enrolls 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.

## BTEC Higher Nationals within the RQF and FHEQ

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

# Contents

<b>Purpose of this specification</b>	<b>1</b>
<b>Qualification titles covered by this specification</b>	<b>2</b>
<b>Qualification Numbers</b>	<b>2</b>
<b>Introduction</b>	<b>3</b>
<b>Structure of the qualification</b>	<b>3</b>
BTEC Level 4 HNC	3
BTEC Level 5 HND	3
<b>Rules of combination for BTEC Levels 4 and 5 Higher National qualifications</b>	<b>4</b>
<b>Key features</b>	<b>9</b>
Progression from the BTEC Level 4 HNC	10
Progression from the BTEC Level 5 HND	10
Professional body recognition	11
National Occupational Standards	11
Qualification Frameworks for Higher National Diplomas	11
<b>Teaching, learning and assessment</b>	<b>12</b>
Units	13
Learning and assessment	14
Grading Higher National units	15
Calculation of the qualification grade	16
Recognising prior learning and achievement	18
<b>Quality assurance of BTEC Higher Nationals</b>	<b>19</b>
<b>Programme design and delivery</b>	<b>21</b>
Mode of delivery	22
Resources	23
Delivery approach	24
Meeting local needs	24
<b>Access and recruitment</b>	<b>25</b>
Restrictions on learner entry	25
Equality Act 2010 and Pearson equality policy	25
English language expectations	26

Professional body contact details	26
How to obtain National Occupational Standards	26
<b>Professional development and training</b>	<b>27</b>
<b>Annexe A</b>	<b>28</b>
Qualification Requirements	28
<b>Annexe B</b>	<b>34</b>
National Occupational Standards (NOS)	34
<b>Annexe C</b>	<b>36</b>
Grade descriptors	36
<b>Annexe D</b>	<b>38</b>
Unit mapping overview	38
Unit mapping in depth	41
<b>Annexe E</b>	<b>46</b>
Calculation of the qualification grade	46

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# Purpose of this specification

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The purpose of a specification as defined by Ofqual is to set out:

- the qualification's objective
- any other qualification that a learner must have completed before taking the qualification
- any prior knowledge, skills or understanding that the learner is required to have before taking the qualification
- units that a learner must have completed before the qualification will be awarded and any optional routes
- any other requirements that a learner must have satisfied before they will be assessed or before the qualification will be awarded
- the knowledge, skills and understanding that will be assessed as part of the qualification (giving a clear indication of their coverage and depth)
- the method of any assessment and any associated requirements relating to it
- the criteria against which the learner's level of attainment will be measured (such as assessment criteria)
- any specimen materials
- any specified levels of attainment.

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# Qualification titles covered by this specification

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**Pearson BTEC Level 4 HNC Diploma in Operations Engineering**

**Pearson BTEC Level 5 HND Diploma in Operations Engineering**

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 Pearson. 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.

The Quality Assurance Agency for Higher Education (QAA) has produced guidelines for centres in preparing programme specifications (reference *Guidelines for preparing programme specifications: UK Quality Code for Higher Education, Part A Chapter A3.*)

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## Qualification Numbers

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

The QNs for qualifications in this publication are:

500/8960/2 Pearson BTEC Level 4 HNC Diploma in Operations Engineering

500/8959/6 Pearson BTEC Level 5 HND Diploma in Operations Engineering



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# Introduction

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This specification contains the units and associated guidance for the Pearson BTEC Level 4 HNC in Operations Engineering and the Pearson BTEC Level 5 HND in Operations 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 our policies regarding access to our qualifications, the design of programmes of study and delivery modes.

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## Structure of the qualification

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### **BTEC Level 4 HNC**

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

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

### **BTEC Level 5 HND**

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

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

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

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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 BTEC Higher National qualifications, accredited from 2010.

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

## **BTEC Level 4 HNC in Operations Engineering**

- 1 Qualification credit value: a minimum of 120 credits. (A maximum of 30 credits may be at level 3; 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 BTEC Higher National qualifications accredited from 2010 to meet local needs. Level rules and mandatory core units must not be changed.
- 6 **Total Qualification Time** Higher National Certificate (HNC) = 1,200 hours
- 7 **Total Guided Learning (GL)** Higher National Certificate (HNC) = 480 hours

## **BTEC Level 5 HND in Operations Engineering**

- 1 Qualification credit value: a minimum of 240 credits. (A maximum of 30 credits may be at level 3; and a maximum of 30 credits may be at level 6.)
- 2 Minimum credit to be achieved at the level of the qualification (level 5) or above: 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 BTEC Higher National qualifications accredited from 2010 to meet local needs. Level rules and mandatory core units must not be changed.
- 7 **Total Qualification Time** Higher National Diploma (HND) = 2,400 hours
- 8 **Total Guided Learning (GL)** Higher National Diploma (HND) = 960 hours

## Structure of the Pearson BTEC Level 4 HNC in Operations 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
	<b>Specialist units group A – choose units with a minimum credit value of 45 credits</b>		
6	Health, Safety and Risk Assessment in Engineering	4	15
7	Business Management Techniques for Engineers	4	15
8	Engineering Design	5	15
36	Statistical Process Control	5	15
43	Plant and Process Principles	5	15
44	Plant Maintenance and Decommissioning	4	15
45	Plant Operations and Performance	5	15
46	Plant and Process Control	5	15
47	Engineering Plant Technology	5	15
48	Analytical and Chemical Composition Measurement	4	15
49	Computer Control of Plant	4	15
50	Condition Monitoring and Fault Diagnosis	5	15
51	Emergency Shutdown and Safety Systems	4	15
52	Energy Management	5	15
54	Industrial Plant Services	5	15
55	Instrumentation and Control Principles	4	15
	<b>Specialist units group B</b>		
4	Mechanical Principles	5	15
5	Electrical and Electronic Principles	5	15
17	Business Improvement Techniques	5	15
20	Quality and Business Improvement	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
26	Employability Skills	5	15

<b>Unit number</b>	<b>Specialist units group B <i>continued</i></b>	<b>Unit level</b>	<b>Unit credit</b>
27	Personal and Professional Development	5	15
28	Research Project	5	20
29	Work-based Experience	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
37	Management of Projects	4	15
38	Managing People in Engineering	5	15
39	Electronic Principles	5	15
40	Knowledge-based Systems and Techniques	5	15
41	Fluid Mechanics	4	15
42	Heat Transfer and Combustion	5	15
57	Mechatronic Systems	4	15
58	Microprocessor Systems	4	15
59	Advanced Mathematics for Engineering	5	15
61	Engineering Thermodynamics	5	15
69	Advanced Computer-aided Design Techniques	4	15
76	Managing the Work of Individuals and Teams	5	15
82	Nuclear Technology and Radiation Safety	4	16
101	Electrical and Electronic Principles	3	10
102	Mechanical Principles and Applications	3	10
103	Further Mathematics for Technicians	3	10

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

## Structure of the Pearson BTEC Level 5 HND in Operations 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
43	Plant and Process Principles	5	15
	<b>Specialist units group A – choose units with a minimum credit value of 75 credits</b>		
6	Health, Safety and Risk Assessment in Engineering	4	15
7	Business Management Techniques for Engineers	4	15
8	Engineering Design	5	15
36	Statistical Process Control	5	15
44	Plant Maintenance and Decommissioning	4	15
45	Plant Operations and Performance	5	15
46	Plant and Process Control	5	15
47	Engineering Plant Technology	5	15
48	Analytical and Chemical Composition Measurement	4	15
49	Computer Control of Plant	4	15
50	Condition Monitoring and Fault Diagnosis	5	15
51	Emergency Shutdown and Safety Systems	4	15
52	Energy Management	5	15
54	Industrial Plant Services	5	15
55	Instrumentation and Control Principles	4	15
	<b>Specialist units group B</b>		
4	Mechanical Principles	5	15
5	Electrical and Electronic Principles	5	15
17	Business Improvement Techniques	5	15
20	Quality and Business Improvement	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
26	Employability Skills	5	15

<b>Unit number</b>	<b>Specialist units group B <i>continued</i></b>	<b>Unit level</b>	<b>Unit credit</b>
27	Personal and Professional Development	5	15
28	Research Project	5	20
29	Work-based Experience	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
37	Management of Projects	4	15
38	Managing People in Engineering	5	15
39	Electronic Principles	5	15
40	Knowledge-based Systems and Techniques	5	15
41	Fluid Mechanics	4	15
42	Heat Transfer and Combustion	5	15
57	Mechatronic Systems	4	15
58	Microprocessor Systems	4	15
59	Advanced Mathematics for Engineering	5	15
61	Engineering Thermodynamics	5	15
69	Advanced Computer-aided Design Techniques	4	15
76	Managing the Work of Individuals and Teams	5	15
82	Nuclear Technology and Radiation Safety	4	16
101	Electrical and Electronic Principles	3	10
102	Mechanical Principles and Applications	3	10
103	Further Mathematics for Technicians	3	10
106	Engineering Maintenance Procedures and Techniques	3	10

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

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# Key features

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The 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 the BTEC HNC/HND 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. The Pearson BTEC Higher Nationals in Operations Engineering have been developed to focus on:

- the education and training of operations and maintenance engineers/technicians who are employed at a professional level in a variety of types of technical work, such as in: operations and maintenance systems design, manufacture, maintenance and technical services areas of the process, mechatronic, or instrumentation and control engineering industry
- providing opportunities for operations and maintenance engineers/technicians to achieve a nationally recognised Level 4 or Level 5 vocationally specific qualification
- providing opportunities for 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 operations and maintenance engineering fields of process, mechatronic, or instrumentation and control
- 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
- preparing for a range of technical and management careers in process, instrumentation and control operations and maintenance engineering
- equipping individuals with knowledge, understanding and skills for success in employment in the process, instrumentation and control operations and maintenance engineering-based industry
- providing specialist studies relevant to individual vocations and professions in which learners are working or intend to seek employment in process, instrumentation and control operations and maintenance engineering and its related industries

- enabling progression to or count towards an undergraduate degree or further professional qualification in process, instrumentation and control operations and maintenance engineering or related area
- providing a significant educational base for progression to Incorporated Engineer level.

## **Progression from the BTEC Level 4 HNC**

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

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 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 Pearson BTEC Level 4 HNC in Operations Engineering offers a progression route for learners who are employed in the operations engineering sector.

## **Progression from the BTEC Level 5 HND**

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The BTEC Level 5 HND provides greater breadth and specialisation than the BTEC Level 4 HNC. BTEC HNDs 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 Pearson BTEC Level 5 HND in Operations 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 operations engineering sector and it is 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 BTEC Level 4 HNC programme.

Progression from this qualification may well be into or within employment in the operations engineering sector where learners may work towards Incorporated Engineer status.

Alternatively, learners could progress to degree courses in related engineering areas such as operations engineering, maintenance engineering or plant and process engineering.



## **Professional body recognition**

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The Pearson BTEC Higher Nationals in Operations Engineering have been developed with career progression and recognition by professional bodies in mind.

This development has been informed by discussions with the Engineering Council UK (EC (UK)) and the Science, Engineering and Manufacturing Technologies Alliance (SEMTEA).

## **National Occupational Standards**

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Pearson BTEC Higher Nationals in Operations Engineering are designed to relate to the National Occupational Standards in the engineering sector at levels 4 and 5, which in turn form the basis of the engineering National Vocational Qualifications (NVQs). 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 and 5 NVQs where appropriate.

## **Qualification Frameworks for Higher National Diplomas**

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In England, Wales and Northern Ireland, BTEC HNC and HND Diplomas may either be awarded by degree-awarding bodies under a licence from Pearson (which allows them to devise, deliver and award Higher National qualifications themselves), or they may be awarded directly by Pearson, as an awarding body regulated by Ofqual. The majority of BTEC HNC and HND Diplomas are awarded by Pearson. Only those HNC and HND Diplomas that are awarded by degree-awarding bodies are included on the Framework for Higher Education Qualifications (FHEQ) (because this framework comprises qualifications awarded by degree-awarding bodies.) BTEC HNC and HND Diplomas awarded directly by Pearson are qualifications at Level 4 and Level 5 on the Regulated Qualifications Framework (RQF) and are subject to the academic standards and regulations of Pearson.

Level descriptors have been used to describe the relative intellectual demand, complexity, depth of learning and learner autonomy associated with the level 4 or 5 level of learning and achievement.

QAA subject and qualification benchmark statements have also been used to provide points of reference for each level.

Employers and higher education providers can expect that typical learners studying for the Pearson BTEC Higher Nationals in Operations Engineering should have developed certain higher level skills and abilities and studied a mandatory curriculum and selected optional specialist units. This detail is contained in the 'Qualification Requirements' in *Annexe A* of this specification.

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# Teaching, learning and assessment

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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 a BTEC Level 4 HNC and a minimum of 240 credits (of which at least 125 must be at level 5 or above) to be awarded a BTEC Level 5 HND.

The assessment of 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 the 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.

**NB** Any level 3 units in BTEC Higher National specifications will appear as they are found in the relevant level 3 specifications (minus references to personal, learning and thinking skills [PLTS] and functional skills [FS].) This means that their format and assessment requirements will be slightly different to level 4 and level 5 units. 'Links' within the level 3 units will relate to units found in the level 3 specification and not to those within the level 4 and level 5 specifications.

## Units

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Units have the following sections.

### **Unit title**

The unit title is on the RQF and this form of words will appear on the learner's Notification of Performance (NOP).

### **Unit reference number**

Each unit is assigned a unit reference number that appears with the unit title on the Register of Regulated Qualifications.

### **Level**

All units and qualifications have a level assigned to them. There are nine levels of achievement, from Entry to Level 8. The Level Descriptors inform the allocation of the level.

### **Credit value**

When a learner achieves a unit, they gain the specified number of credits.

### **Guided learning hours**

Guided learning hours are the times when a tutor, trainer or facilitator is present to give specific guidance towards the learning aim for a programme. This definition covers lectures, tutorials and supervised study in, for example, open learning centres and learning workshops. It also includes assessment by staff where learners are present. It does not include time spent by staff marking assignments or homework where the learner is not present.

### **Unit aim**

This gives a summary of what the unit aims to do.

### **Essential resources**

This section lists any specialist resources needed to deliver the unit. The centre will be asked to make sure that these resources are in place when it seeks approval from Pearson to offer the qualification.

### **Learning outcomes**

The learning outcomes of a unit set out what a learner knows, understands or is able to do as the result of a process of learning.

### **Assessment criteria**

Assessment criteria specify the standard required by the learner to achieve each learning outcome.

### **Unit amplification**

This section clarifies what a learner needs to know to achieve a learning outcome.

## Information for tutors

This section gives tutors information on delivery and assessment. It contains the following subsections.

- *Delivery* – explains the content’s relationship to the learning outcomes and offers guidance on possible approaches to delivery.
- *Assessment* – gives information about the evidence that learners must produce, together with any additional guidance if appropriate. This section should be read in conjunction with the assessment criteria.
- *Suggested resources* – lists resource materials that can be used to support the teaching of the unit, for example books, journals and websites.

## Learning and assessment

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The purpose of assessment is to ensure that effective learning has taken place of the content of each unit. 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. For example, by capitalising on their strengths, and clear and 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.**

## Grading Higher National units

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The grading of 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.

Each of the generic merit and distinction grade descriptors should be amplified by use of **indicative characteristics** which exemplify the merit and distinction grade descriptors. 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.

Additional guidance on contextualisation of grade descriptors can be found in HN Delivery Guides on the website.

### Summary of grades

In order to achieve a <b>pass</b> in a unit	<ul style="list-style-type: none"><li>all learning outcomes and associated assessment criteria have been met</li></ul>
In order to achieve a <b>merit</b> in a unit	<ul style="list-style-type: none"><li>pass requirements achieved</li><li>all merit grade descriptors achieved and all prescribed indicative characteristics.</li></ul>
In order to achieve a <b>distinction</b> in a unit	<ul style="list-style-type: none"><li>pass and merit requirements achieved</li><li>all distinction grade descriptors achieved and all prescribed indicative characteristics.</li></ul>

## Calculation of the qualification grade

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### Pass qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at a pass grade (see section *Rules of combination for the BTEC Level 4 and 5 Higher National qualifications*). The Rules of combination have been summarised below:

#### BTEC HNC Diplomas

To achieve the qualification a learner must:

- achieve at least 120 credits at or above the level of the qualification (a maximum of 55 credits may be at Level 5)
- achieve a minimum of 65 credits at Level 4
- complete a valid combination of units.

#### BTEC HND Diplomas

To achieve the qualification a learner must:

- achieve at least 240 credits at or above the level of the qualification
- achieve a minimum of 125 credits at Level 5 or above.

The best valid combination of units is used to calculate the overall grade, e.g. if a learner has completed more than the minimum number of optional units at the appropriate level the best performance from these will be used.

All learners will receive a Notification of Performance showing all unit grades whether or not they were included in the calculation for the overall grade.

### Qualification grades above pass grade

#### BTEC HNC Diplomas

Calculation of the BTEC HNC qualification grade is based on the learner's best performance in units at or above the level of the qualification to the value of 75 credits:

- The best 75 credits must come from a maximum of 120 credits as a valid rule of combination
- The units from which the best 75 credits are selected come from the whole qualification including the mandatory core credit.

This means that credit from some mandatory core units is likely to form part of the best 75 credits in most programmes (the mandatory core credit units will automatically be included in the calculation once the maximum amount of credit for optional specialist units for the rule of combination is used up.)

It is the responsibility of a centre to ensure that a correct unit combination is adhered to.

## Qualification grades

Learners will be awarded a pass, merit or distinction qualification grade using the points gained through the 75 best credits based on unit achievement.

### Unit credit points available for specified unit grades, for either Level 4 or Level 5 units

Unit points per credit		
Pass	Merit	Distinction
0	1	2
Example for level 4 or level 5 unit of 15 credits		
Pass	Merit	Distinction
0	15	30

### BTEC Level 4 HNC overall qualification grades

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

### BTEC HND Diplomas

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

If a learner moves from HNC to HND, credits at Level 5 or above from both the HNC and HND can contribute to the best 75 credits of the overall HND grade. Note that for HND learners, level 4 units do not count towards the qualification grade.

Calculation of the BTEC HND qualification grade is based on the learner's best performance in units at or above the level of the qualification – i.e. **only units at level 5** can be counted towards the value of 75 credits:

- The best 75 credits must come from a maximum of 240 credits as a valid rule of combination
- The units from which the 75 best credits are selected come from the whole qualification including the mandatory core credit, but must be level 5 units or above.

This means that credit from some mandatory core units is likely to form part of the best 75 credits in most programmes (the mandatory core credit units will automatically be included in the calculation once the maximum amount of credit for optional specialist units for the rule of combination is used up.)

It is the responsibility of a centre to ensure that a correct unit combination is adhered to.

## Qualification grades

Learners will be awarded a pass, merit or distinction qualification grade using the points gained through the 75 best credits based on unit achievement.

### Unit credit points for specified unit grades at Level 5 only

Unit points per credit		
Pass	Merit	Distinction
0	1	2

### BTEC Level 5 HND overall qualification grades

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

*Annexe E* gives examples of how qualification grades are calculated.

## Recognising prior learning and achievement

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### 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.

Pearson 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 Pearson's policy on RPL, please see our *Recognition of Prior Learning Policy and Process* on our website.



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# Quality assurance of BTEC Higher Nationals

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Pearson's quality assurance system for all BTEC higher-level programmes 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 BTEC higher-level programmes at Levels 4–7 comprises of three key components:

## 1) Approval process

Centres new to the delivery of BTEC Higher National qualifications will be required to seek approval through the existing Pearson 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 Pearson 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 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. Pearson reserves the right to confirm independently that these arrangements are operating to Pearson's satisfaction.

Pearson 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 the BTEC higher-level programmes on the Regulated Qualifications Framework at Levels 4-7 are subject to an independent assessment review by a Pearson-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, Pearson 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.

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# Programme design and delivery

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The BTEC Higher National Certificate (HNC) is a Level 4 qualification made up of 120 credits. It is usually studied full-time over one year, or part-time over two years.

The BTEC Higher National Diploma (HND) is a Level 4 and Level 5 qualification made up of 240 credits. It is usually studied full-time over two years, or part-time over four years.

Pearson would expect that an HND student would have achieved at least 90 credits at Level 4 before progressing to Level 5 units. This allows for the students to submit the remaining 30 credits at Level 4 while undertaking their Level 5 study.

Students undertaking an HND who fail to successfully complete the full qualification may be awarded an HNC, if their credit achievement permits.

BTEC Higher Nationals 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 each qualification in the defined structures provided in this document.

All units are usually 15 credits in value, or a multiple thereof. These units have been designed from a learning time perspective, and are expressed in terms of **Total Qualification Time (TQT)**. TQT is an estimate of the total amount of time that could reasonably be expected to be required for a student to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification. TQT includes undertaking each of the activities of Guided Learning, Directed Learning and Invigilated Assessment. Each 15-credit unit approximates to a TQT of 150 hours and 60 hours of Guided Learning. This value has been allocated according to input from curriculum writers.

**Total Qualification Time** Higher National Certificate (HNC) = 1,200 hours

**Total Qualification Time** Higher National Diploma (HND) = 2,400 hours

Examples of activities which can contribute to Total Qualification Time include:

- Guided Learning
- Independent and unsupervised research/learning
- Unsupervised compilation of a portfolio of work experience
- Unsupervised e-learning
- Unsupervised e-assessment
- Unsupervised coursework
- Watching a pre-recorded podcast or webinar
- Unsupervised work-based learning.

**Guided Learning Hours (GLH)** are defined as the time when a tutor 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. Guided Learning includes any supervised

assessment activity; this includes invigilated examination and observed assessment and observed work-based practice.

**Total Guided Learning (GL)** Higher National Certificate (HNC) = 480 hours

**Total Guided Learning (GL)** Higher National Diploma (HND) = 960 hours

Some examples of activities which can contribute to Guided Learning include:

- Classroom-based learning supervised by a tutor
- Work-based learning supervised by a tutor
- Live webinar or telephone tutorial with a tutor in real time
- E-learning supervised by a tutor in real time
- All forms of assessment which take place under the immediate guidance or supervision of a tutor or other appropriate provider of education or training, including where the assessment is competence-based and may be turned into a learning opportunity.

Centres are advised to consider these definitions 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 Pearson Level 5 BTEC Higher Nationals in Operations Engineering with the units in this specification.

## **Mode of delivery**

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Pearson does not define the mode of study for the 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 'distance learning' 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 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

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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 Pearson.

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

## **Delivery approach**

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It is important that centres develop an approach to teaching and learning that supports the specialist vocational nature of the 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**

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Centres should note that the qualifications set out in these specifications have been developed in consultation with centres, employers and relevant professional organisations.

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.

Where centres identify a specific need that cannot be addressed using the units in this specification, centres can seek approval from Pearson to use units from other BTEC Higher National qualifications accredited in 2010. Centres will need to justify the need for importing units from other specifications and Pearson will ensure that the vocational focus of the qualification remains the same.

Applications must be made **in advance** of delivery by 31 January in the year of registration (see the website for details).

The flexibility to import standard units from other RQF BTEC Higher National specifications is **limited to a maximum of 30 credits in a BTEC HNC qualification and a maximum of 60 credits only in any BTEC HND qualification**. This is an overall maximum and centres should check the 'Rules of Combination' information for the specific qualification to confirm the actual requirements. 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. The centre must ensure that approved units are used only in eligible combinations.

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# Access and recruitment

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Pearson'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 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 review the applicant's prior qualifications and/or experience, considering whether this profile shows that they have the potential to achieve the qualification.

## Restrictions on learner entry

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The BTEC Higher National qualifications are accredited on the RQF for learners in the following age groups:

- 16-18 years old
- 18 years and older.

## Equality Act 2010 and Pearson equality policy

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Equality and fairness are central to our work. Our equality policy requires all learners to have equal opportunity to access our qualifications and assessments, and our qualifications are required to be awarded in a way that is fair to every learner.

We are committed to making sure that:

- learners with a protected characteristic (as defined by the Equality Act 2010) are not, when they are undertaking one of qualifications, disadvantaged in comparison with learners who do not share that characteristic
- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

You can find details on how to make adjustments for learners with protected characteristics in the policy document *Access Arrangements, Reasonable Adjustments and Special Considerations*, available on our website.

An adjustment may not be considered reasonable if it involves unreasonable costs and/or timeframes or affects the security or integrity of the assessment.

There is no duty on awarding organisations to make any adjustment to the Assessment Objectives being tested in an assessment.

## **English language expectations**

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Centres delivering BTEC level 4 to 7 programmes are expected to ensure that all learners who are non-native English speakers or who have not studied the final two years of school in English, can demonstrate capability in English at a standard commensurate with:

- IELTS 5.5, with a minimum of 5.0 being awarded on individual sections for a level 4 or 5 qualification
- IELTS 6.5 for a level 6 or 7 qualification

Pearson's Standard Verifiers (EE) will expect centres to demonstrate that their learners meet these expectations.

## **Professional body contact details**

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

Engineering Council  
5<sup>th</sup> Floor  
Woolgate Exchange  
25 Basinghall Street  
London EC2V 5HA

Telephone: 02032060500  
Website: [www.engc.org.uk](http://www.engc.org.uk)

## **How to obtain National Occupational Standards**

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

SEMATA  
Head Office  
The Orient Centre, Unit 2  
Greycaine Road  
Watford WD24 7GP

Telephone: 0845 643 9001  
Website: [www.semta.org.uk](http://www.semta.org.uk)



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# Professional development and training

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Pearson supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered on our website at: [qualifications.pearson.com/en/support/training-from-pearson-uk](http://qualifications.pearson.com/en/support/training-from-pearson-uk)

The support we offer focuses on a range of issues, such as:

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

The national programme of training we offer is on our website. You can request centre-based training through the website or you can contact one of our advisers in the Training from Pearson UK team via Customer Services to discuss your training needs.

## **BTEC training and support for the lifetime of the qualifications**

**Training and networks:** our training programme ranges from free introductory events through sector-specific opportunities to detailed training on all aspects of delivery, assignments and assessment. We also host some regional network events to allow you to share your experiences, ideas and best practice with other BTEC colleagues in your region.

**Regional support:** our team of Curriculum Development Managers and Curriculum Support Consultants, based around the country, are responsible for providing advice and support in centres. They can help you with planning and curriculum developments.

To get in touch with our dedicated support teams please visit our website [qualifications.pearson.com/en/support/contact-us](http://qualifications.pearson.com/en/support/contact-us)

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# Annexe A

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## Qualification Requirements

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### Rationale

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

- the education and training of operations and maintenance engineers/technicians who are employed at a professional level in a variety of types of technical work, such as operations and maintenance systems design, manufacture, maintenance and technical services areas of the process, mechatronic, or instrumentation and control engineering industry
- providing opportunities for operations and maintenance 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 operations and maintenance engineering fields of process, mechatronic, or instrumentation and control or related area
- 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

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
- preparing for a range of technical and management careers in process, instrumentation and control operations and maintenance engineering
- equipping individuals with knowledge, understanding and skills for success in employment in the process, instrumentation and control operations and maintenance engineering-based industry

- providing specialist studies relevant to individual vocations and professions in which learners are working or intend to seek employment in process, instrumentation and control operations and maintenance engineering and its related industries
- enabling progression to or count towards an undergraduate degree or further professional qualification in process, instrumentation and control operations and maintenance engineering or related area
- providing a significant educational base to provide 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 operations and maintenance engineering problems and using this knowledge to model and analyse routine operations and maintenance engineering systems, processes and products
- major operations and maintenance 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 operations and maintenance engineering
- 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 Operations Engineering Higher National programme, in particular, integrated exercises involving a technical investigation, which incorporates a financial appreciation
- knowledge of the calculation of costs associated with engineered products and services
- fundamental analytical knowledge and techniques used for analysis, modelling and solution of realistic engineering problems within operations and maintenance engineering
- a knowledge of routine mathematical methods essential to operations and maintenance 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:

- opportunity to experience a design project through appreciation of synthesising parameters affecting design solutions
- the application of engineering principles to the design and manufacture of products, systems and services
- the experience of design modification for an existing system, component or process to meet a specified requirement
- undertaking routine practical or simulation tests of a design solution, report and comment on results
- searching for information related to operations and maintenance engineering design solution and present it for discussion
- applying an understanding of mathematics, science, information technology, design, business and engineering practice to solve routine problems
- an extended range of operations and maintenance principles for more advanced study and which underpin the design and operation of operations and maintenance engineering systems in plant and process/instrumentation and control/mechatronics engineering
- an overview of how principles of design, development, operation and maintenance encourage good practice in the workplace, plant and equipment
- examining types of maintenance procedures and management strategies including decommissioning and safety shutdown systems
- an awareness of the principles of health and safety planning and implementation in an operations engineering environment
- an introduction to programmable logic controller concepts and their applications in engineering and robot technology
- an understanding of the issues involved in managing the work of individuals employed in the operations and maintenance engineering industry
- application of relevant statistical techniques and other quality assurance, measurement and test techniques and management principles, and conditioning monitoring techniques and fault diagnosis
- experience of economic plant design using computer-aided design packages
- an extended range of operations engineering principles for more advanced study and which underpin the design and operation of engineering systems including strengths of materials and mechanics of machines
- a background knowledge and understanding of the properties, selection, processing and use of materials
- an extended range of knowledge and understanding of fluid-power systems and evaluating such systems in industrial applications
- an evaluation of a range of services that exist in industry and demonstrate the multi-diversity of plant engineering

- a knowledge of modern material handling systems, logistics and strategies employed, methods of identification and tracking, systems to control material flows, and material handling equipment
- an understanding of robot technology including how they are linked together as a system, various programming methods and factors which must be taken into account when selecting, installing and operating industrial robots
- an understanding of maintenance procedures and policies and strategies for management of plant and equipment
- a basic knowledge of energy management and energy conservation awareness principles and techniques including utilisation of electrical energy used in industry and commercial organisations
- a basic knowledge of skills commonly used in the management of inventory and purchasing
- the engineering principles which underpin the design and operation of engineering systems and equipment including thermodynamic, power transmission, static and dynamic fluid systems and combustion processes and control systems
- an evaluation of mechatronic systems within industrial environments
- an understanding of effective control of plant and process and the role computers, programming, electronic and communication systems plays in modern process and manufacturing plant
- a detailed understanding of analogue and digital electronics used in a range of modern electronic systems including the use of combinational and sequential logic
- an understanding of microprocessor-based systems and their use in instrumentation/control/communication systems
- using number systems, graphical and numerical methods, vectors, matrices and ordinary differential equations to analyse, model and solve realistic engineering problems
- a further detailed knowledge of project planning management skills to plan, analyse and control a project
- an examination of the basic principles of Total Quality Management (TQM) and the key factors that underpin Quality Assurance (QA) techniques and the application of Quality Control (QC) techniques
- an awareness and familiarisation with the principles and applications of integrated logistics support management
- an examination of the basic principles of continuous improvement and the development and understanding of the key factors which underpin the application of improvement methodologies.

## Entry prerequisites

The fundamental principles of Pearson'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.

The 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. Learners 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
- an AVCE/GNVQ in Engineering
- a GCE level profile that 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:

- 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.



# Annexe B

## National Occupational Standards (NOS)

### 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 Pearson BTEC Higher Nationals in Operations 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.

NVQ	BTEC HN unit														
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 17	Unit 20	Unit 21	Unit 22	Unit 23	Unit 24	Unit 25
Level 4 NVQ in Engineering Management						Unit 4.01		Units 4.12, 4.13					Unit 4.17		
Level 4 NVQ in Business Improvement Techniques									Units 8, 11, 12, 36	Units 5 and 21					



		BTEC HN unit													
NVQ	Unit 26	Unit 27	Unit 28	Unit 29	Unit 32	Unit 33	Unit 34	Unit 35	Unit 36	Unit 37	Unit 38	Unit 40	Unit 41	Unit 42	Unit 44
Level 4 NVQ in Engineering Management			Units 4.5, 4.6, 4.8, 4.9												Unit 4.24
Level 4 NVQ in Business Improvement Techniques									Unit 14						

		BTEC HN unit														
NVQ	Unit 45	Unit 46	Unit 47	Unit 48	Unit 49	Unit 50	Unit 51	Unit 52	Unit 54	Unit 55	Unit 57	Unit 58	Unit 59	Unit 61	Unit 69	Unit 76
Level 4 NVQ in Engineering Management	Unit 4.21															
Level 4 NVQ in Business Improvement Techniques																

# 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

<b>Merit grade descriptors</b>	<b>Exemplar indicative characteristics</b> <b>Centres can identify and use other relevant characteristics. This is NOT a tick list.</b>
In order to achieve a <b>merit</b> the learner must:	The learner's evidence shows, for example:
<ul style="list-style-type: none"> <li>• identify and apply strategies to find appropriate solutions</li> </ul>	<ul style="list-style-type: none"> <li>• effective judgements have been made</li> <li>• complex problems with more than one variable have been explored</li> <li>• an effective approach to study and research has been applied</li> </ul>
<ul style="list-style-type: none"> <li>• select/design and apply appropriate methods/techniques</li> </ul>	<ul style="list-style-type: none"> <li>• relevant theories and techniques have been applied</li> <li>• a range of methods and techniques have been applied</li> <li>• a range of sources of information has been used</li> <li>• the selection of methods and techniques/sources has been justified</li> <li>• the design of methods/techniques has been justified</li> <li>• complex information/data has been synthesised and processed</li> <li>• appropriate learning methods/techniques have been applied</li> </ul>
<ul style="list-style-type: none"> <li>• present and communicate appropriate findings</li> </ul>	<ul style="list-style-type: none"> <li>• the appropriate structure and approach has been used</li> <li>• coherent, logical development of principles/concepts for the intended audience</li> <li>• a range of methods of presentation have been used and technical language has been accurately used</li> <li>• communication has taken place in familiar and unfamiliar contexts</li> <li>• the communication is appropriate for familiar and unfamiliar audiences and appropriate media have been used.</li> </ul>

## Distinction grade

Distinction grade descriptors	Exemplar indicative characteristics <b>Centres can identify and use other relevant characteristics. This is NOT a tick list.</b>
In order to achieve a <b>distinction</b> the learner must:	The learner's evidence shows, for example:
<ul style="list-style-type: none"> <li>• use critical reflection to evaluate own work and justify valid conclusions</li> </ul>	<ul style="list-style-type: none"> <li>• conclusions have been arrived at through synthesis of ideas and have been justified</li> <li>• the validity of results has been evaluated using defined criteria</li> <li>• self-criticism of approach has taken place</li> <li>• realistic improvements have been proposed against defined characteristics for success</li> </ul>
<ul style="list-style-type: none"> <li>• take responsibility for managing and organising activities</li> </ul>	<ul style="list-style-type: none"> <li>• autonomy/independence has been demonstrated</li> <li>• substantial activities, projects or investigations have been planned, managed and organised</li> <li>• activities have been managed</li> <li>• the unforeseen has been accommodated</li> <li>• the importance of interdependence has been recognised and achieved</li> </ul>
<ul style="list-style-type: none"> <li>• demonstrate convergent/lateral/creative thinking</li> </ul>	<ul style="list-style-type: none"> <li>• ideas have been generated and decisions taken</li> <li>• self-evaluation has taken place</li> <li>• convergent and lateral thinking have been applied</li> <li>• problems have been solved</li> <li>• innovation and creative thought have been applied</li> <li>• receptiveness to new ideas is evident</li> <li>• effective thinking has taken place in unfamiliar contexts.</li> </ul>

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# Annexe D

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## Unit mapping overview

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The BTEC Higher National units in Operations Engineering (specification start date 01/09/2010) are mapped against the 2003 BTEC Higher National units in Operations Engineering (specification end date 31/12/2010), in the following tables:

Unit number	2010 unit title	Maps to 2003 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	10	F
5	Electrical and Electronic Principles	35	F
6	Health, Safety and Risk Assessment in Engineering	7	F
7	Business Management for Engineers	1	F
8	Engineering Design	6	F
17	Business Improvement Techniques	N/A	N
20	Quality and Business Improvement	43	F
21	Materials Engineering	22	F
22	Programmable Logic Controllers	28	F
23	Engineering Procurement	24	F
24	Applications of Pneumatics and Hydraulics	12	N
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
32	Industrial Robot Technology	25	F
33	Workplace Study and Ergonomics	N/A	N
34	Integrated Logistical Support Management	42	F

<b>Unit number</b>	<b>2010 unit title</b>	<b>Maps to 2003 unit number</b>	<b>Level of similarity between units</b>
35	Further Analytical Methods for Engineers	39	F
36	Statistical Process Control	29	F
37	Management of Projects	40	F
38	Managing People in Engineering	45	F
39	Electronic Principles	36	F
40	Knowledge-Based Systems and Techniques	N/A	N
41	Fluid Mechanics	11	F
42	Heat Transfer and Combustion	14	F
43	Plant and Process Principles	4	F
44	Plant Maintenance and Decommissioning	17	F
45	Plant Operations and Performance	18	F
46	Plant and Process Control	20	F
47	Engineering Plant Technology	9	F
48	Analytical and Chemical Composition Measurement	31	F
49	Computer Control of Plant	19	F
50	Condition Monitoring and Fault Diagnosis	27	F
51	Emergency Shutdown and Safety Systems	26	F
52	Energy Management	15	F
54	Industrial Plant Services	16	F
55	Instrumentation and Control Principles	8	F
57	Mechatronic Systems	32	P
58	Microprocessor Systems	37	F
59	Advanced Mathematics for Engineering	N/A	N
61	Engineering Thermodynamics	13	F
69	Advanced Computer-aided Design Techniques	21	F

<b>Unit number</b>	<b>2010 unit title</b>	<b>Maps to 2003 unit number</b>	<b>Level of similarity between units</b>
76	Managing the Work of Individuals and Teams	44	F
82	Nuclear Technology and Radiation Safety	4	16
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

The BTEC Higher National units in Operations Engineering (specification start date 01/09/2010) are mapped against the 2003 BTEC Higher National units in Operations Engineering (specification end date 31/12/2010).

2010 units		2003 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	10	Mechanical Principles	Full mapping
5	Electrical and Electronic Principles	35	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	6	Engineering Design	Full mapping
17	Business Improvement Techniques			New unit
20	Quality and Business Improvement	43	Quality and Business Improvement	New unit

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	Name	Number	Name	
21	Materials Engineering	22	Materials Engineering	Full mapping
22	Programmable Logic Controllers	28	Programmable Logic Controllers	Full mapping
23	Engineering Procurement	24	Procurement	Full mapping
24	Applications of Pneumatics and Hydraulics	12	Applications of Pneumatics and Hydraulics	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
32	Industrial Robot Technology	25	Robot Technology	Full mapping
33	Workplace Study and Ergonomics			New unit
34	Integrated Logistical Support Management	42	Integrated Logistical Support Management	New unit
35	Further Analytical Methods for Engineers	39	Further Analytical Methods for Engineers	Full mapping
36	Statistical Process Control	29	Statistical Process Control	Full mapping
37	Management of Projects	40	Project Management	Full mapping



2010 units		2003 units		Mapping/comments (new topics in italics)
Number	Name	Number	Name	
38	People Management	45	Managing People in Engineering	Full mapping
39	Electronic Principles	36	Electronics	Full mapping
40	Knowledge-Based Systems and Techniques			New unit
41	Fluid Mechanics	11	Fluid Mechanics	Full mapping
42	Heat Transfer and Combustion	14	Heat Transfer and Combustion	Full mapping
43	Plant and Process Principles	4	Plant and Process Principles	Full mapping
44	Plant Maintenance and Decommissioning	17	Plant Maintenance and Management	Full mapping
45	Plant Operations and Performance	18	Plant Operations and Performance	Full mapping
46	Plant and Process Control	20	Plant Process and Control	Full mapping
47	Engineering Plant Technology	9	Engineering Plant Technology	Full mapping
48	Analytical and Chemical Composition Measurement	31	Analytical Instrumentation	Full mapping
49	Computer Control of Plant	19	Computer Control of Plant	Full mapping
50	Condition Monitoring and Fault Diagnosis	27	Condition Monitoring and Fault Diagnosis	Full mapping

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	Name	Number	Name	
51	Emergency Shutdown and Safety Systems	26	Emergency Shutdown and Safety Systems	Full mapping
52	Energy Management	15	Energy Management	Full mapping
54	Industrial Plant Services	16	Industrial Plant Services	Full mapping
55	Instrumentation and Control Principles	8	Instrumentation and Control Principles	Full mapping
57	Mechatronic Systems	32	Mechatronic System Principles	Full mapping for learning outcomes 1 and 3. <i>Electro-mechanical models and components</i> and <i>mechatronic design philosophies</i> now included
58	Microprocessor Systems	37	Microprocessor Systems	Full mapping
59	Advanced Mathematics for Engineering			New unit
61	Engineering Thermodynamics	13	Engineering Thermodynamics	Full mapping
69	Advanced Computer-aided Design Techniques	21	Advanced Computer-aided Design Techniques	Full mapping
76	Managing the Work of Individuals and Teams	44	Managing the Work of Individuals and Teams	Full mapping
82	Nuclear Technology and Radiation Safety			New Unit
101	Electrical and Electronic Principles			New unit

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	Name	Number	Name	
102	Mechanical Principles and Applications			New unit
103	Further Mathematics for Engineering Technicians			New unit

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# Annexe E

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## Calculation of the qualification grade

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### 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 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 table below).

### Points available per credit at specified unit grades

Points per credit		
Pass	Merit	Distinction
0	1	2

So a 15 credit unit awarded a merit grade will gain 15 points.

### Qualification grades

#### BTEC Level 4 HNC

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

#### BTEC Level 5 HND

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

These are some examples of how the HNC Diploma grades are calculated:

**Example 1: Achievement of a BTEC HNC Diploma with Pass grade**

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	0	
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	M	1	15
Unit 4	Mandatory core unit	4	15	M	1	15
Unit 15	Specialist unit	5	15	P	0	
Unit 17	Specialist unit	5	15	P	0	
Unit 18	Specialist unit	4	15	M	1	15
Unit 12	Specialist unit	4	15	M	1	15
Unit 14	Specialist unit	4	10	D	2	20
	<b>Qualification total requirement 120</b>		<b>130</b>			<b>60</b>

Unit 14 is not included as it is an additional unit on top of the 120 credit qualification

The learner can only include the points from the best 75 out of 120 credits in a valid combination.

**Example 2: Achievement of a BTEC HNC Diploma with Merit grade**

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	M	1	15
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	M	1	15
Unit 4	Mandatory core unit	4	15	P	0	
Unit 15	Specialist unit	5	15	P	0	
Unit 9	Specialist unit	4	15	M	1	15
Unit 18	Specialist unit	4	15	M	1	15
Unit 12	specialist unit	4	15	M	1	15
	<b>Qualification total requirement 120</b>		<b>120</b>			<b>75</b>

The best 75 credits include both core and optional units.

The learner has sufficient points for a merit.

**Example 3: Achievement of an HNC Diploma with Distinction grade**

		Level	Credit	Grade	Grade points	Points per unit (weighting x credit points)
Unit 1	Mandatory core unit	4	15	M	1	(15)
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	D	2	30
Unit 4	Mandatory core unit	4	15	P	0	
Unit 15	Specialist unit	4	15	D	2	30
Unit 17	Specialist unit	4	15	D	2	30
Unit 9	Specialist unit	4	15	D	2	30
Unit 12	Specialist unit	4	15	D	2	30
	<b>Qualification total requirement- 120</b>		<b>120</b>			<b>150</b>

The learner has grade points in more than 75 credits. The best performance is used to calculate the grade. These can be level 4/5 for the HNC

The learner has enough points for a Distinction from 75 credits.

### Examples for the HND Diploma:

The tables below give examples of how the overall grade is determined.

**Only points from units at or above the level of the qualification can be counted towards the grade.**

**Examples used are for illustrative purposes only. Other unit combinations are possible.**

#### Example 1: Achievement of an HND Diploma with a pass grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	M	X	
Unit 4	Mandatory core unit	4	15	M	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	P	0	
Unit 7	Mandatory core unit	5	15	M	1	15
Unit 8	Mandatory core unit	5	20	P	0	
Unit 20	Specialist unit	5	15	M	1	15
Unit 21	Specialist unit	5	15	P	0	
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	15
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	15
	<b>Qualification grade totals</b>	<b>Min 125 at level 5</b>	<b>245</b>			<b>60</b>

Count the points from level 5 units for the best 75 credits  
X these units are **below** the level of the HND Diploma so not counted for grading

The learner has sufficient points for a pass grade.

## Example 2

### Achievement of an HND Diploma with a Merit grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	M	X	
Unit 4	Mandatory core unit	4	15	M	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	M	1	15
Unit 7	Mandatory core unit	5	15	D	2	30
Unit 8	Mandatory core unit	5	20	D	2	40
Unit 20	Specialist unit	5	15	M	1	15
Unit 21	Specialist unit	5	15	M	1	(15)
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	(15)
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	(15)
Unit 36	Specialist unit	5	10	D	2	20
<b>Qualification grade totals</b>		<b>Min 125 at level 5</b>	<b>255</b>			<b>120</b>

The learner can be considered for a merit: only count the points from **the best 75** credits from a valid combination of 240 credits

X these units are **below** the level of the qualification so **cannot** be counted for grading

The best 75 credits include both mandatory core and optional units

( ) these units are not counted in the overall score

The learner has sufficient points for a merit grade.



### Example 3

#### Achievement of an HND Diploma with a distinction grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	D	X	
Unit 4	Mandatory core unit	4	15	D	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	D	2	30
Unit 7	Mandatory core unit	5	15	D	2	30
Unit 8	Mandatory core unit	5	20	D	2	30
Unit 20	Specialist unit	5	15	D	2	30
Unit 21	Specialist unit	5	15	D	2	30
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	(15)
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	(15)
Unit 36	Specialist unit	4	15	P	X	
<b>Qualification grade totals</b>		<b>Min 125 at level 5</b>	<b>245</b>			<b>150</b>

The learner can be considered for a distinction: only count the points from level 5 units for the best 75 credits from a valid combination of **240** credits  
 () these units are not counted in the overall score  
 X not counted as **below the** level of the qualification.

The learner has sufficient points for a distinction grade.

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