

# BTEC International Level 3 - **Operations and Maintenance Engineering** - Content Mapping

| 2010 QCF Unit |                                    | International BTEC Level 3 unit to which 2010 unit relates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Areas of content in the 2010 unit not covered in the International unit |
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| No.           | Title                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                         |
| 1             | Health and safety in the workplace | <p><b>Fully covered in:</b></p> <p><b>Unit 2 Delivery of engineering processes safety as a team</b></p> <p>A2 Health and safety requirements<br/>C3 Health and safety risk assessment</p> <p><b>Unit 41 Manufacturing secondary machining processes</b></p> <p>B1 Health and safety requirements when setting up secondary press machines<br/>B2 Risk assessment</p> <p><b>Unit 5 Specialist engineering project</b></p> <p>B2 Risk and issues project management process processes</p> <p><b>Unit 46 Manufacturing joining, finishing and assembly processes</b></p> <p>A3 Safe working practices when using joining processes</p> |                                                                         |

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| 2             | Communications for engineering technicians | <p><b>Fully covered in:</b></p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>LA A Explore design triggers, challenges, constraints, opportunities and operational requirements</p> <p>B1 Design proposals</p> <p>B2 Communicating designs</p> <p><b>Unit 2 Delivery of engineering processes safety as a team</b></p> <p>C4 Preparation activities for batch manufacture or batch service delivery</p> <p>A3 Human factors affecting the performance of engineering processes</p> <p>C1 Principles of effective teams</p> <p><b>Unit 5 Specialist engineering project</b></p> <p>B4 Design information</p> |                                                                         |
| 3             | Engineering project                        | <p><b>Fully covered in:</b></p> <p><b>Unit 5 A specialist engineering project</b></p> <p>A1 Project life cycle</p> <p>A2 Project idea generation and solution development</p> <p>A3 Feasibility study</p> <p>B1 Planning and monitoring project management processes</p> <p>B2 Risk and issue project management processes</p> <p>B3 Technical specification</p> <p>B4 Design information</p> <p>C1 Undertake and test the solution to the problem</p> <p>C2 Demonstrate relevant behaviours</p> <p>C3 Present a solution to the problem</p>                                                                                        |                                                                         |

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| 4             | Mathematics for engineering technicians | <p><b>Fully covered in:</b></p> <p><b>Unit 1 Mechanical principles</b></p> <p>A1 Algebraic methods<br/>A2 Trigonometric methods</p> <p><b>Unit 7 Calculus to solve engineering problems</b></p> <p>A2 Methods of differentiation<br/>B1 Integration as the reverse/inverse of differentiation<br/>B2 Integration as a summing tool<br/>B3 Numerical integration<br/>C4 Solution implementation</p> <p><b>Unit 8 Further engineering mathematics</b></p> <p>D1 Statistical techniques</p> <p><b>Unit 57 Electrical and electronic principles</b></p> <p>A1 Algebraic Methods<br/>A2 Trigonometric methods<br/>A3 Statistical methods</p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>A9 Statistical methods</p> |                                                                         |

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| 5             | <b>Mechanical principles and applications</b> | <p><b>Fully covered in:</b></p> <p><b>Unit 1 Mechanical principles</b></p> <p>B1 Static engineering systems<br/> B2 Loaded components<br/> C1 Kinetic parameters<br/> C2 Dynamic parameters<br/> D1 Fluid systems<br/> D2 Immersed bodies</p> <p><b>Unit 28 Dynamic mechanical principles in practice</b></p> <p>A1 Dynamics of systems undergoing acceleration<br/> A2 Linear systems</p> <p><b>Unit 31 Thermodynamic principles and practice</b></p> <p>B1 Closed thermodynamic systems<br/> B2 Open thermodynamic systems</p> |                                                                         |
| 6             | <b>Electrical and electronic principles</b>   | <p><b>Fully covered in:</b></p> <p><b>Unit 57 Electrical and electronic principles</b></p> <p>B1 Static and direct current electricity principles<br/> B2 Direct current circuit theory<br/> B3 Direct current networks<br/> C1 Magnetism<br/> C2 Electromagnetic induction<br/> D1 Alternating current waveforms<br/> D2 Single-phase alternating current principles</p>                                                                                                                                                        |                                                                         |

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| 7             | Business operations in engineering | <p><b>Fully covered in:</b></p> <p><b>Unit 4 Applied commercial and quality principles in engineering</b></p> <p>B1 Reasons for cost control and types of costs<br/>B2 Activity-based costing method</p> <p><b>Unit 2 Delivery of engineering processes safely as team</b></p> <p>A1 Common engineering processes</p> <p><b>Unit 58 Entrepreneurship and entrepreneurship in practice</b></p> <p>A1 Features of the environment<br/>A2 Influence of stakeholders on planning and decision making<br/>A3 Organisational risks</p> <p><b>Unit 41 Manufacturing secondary machining processes</b></p> <p>B1 Health and safety requirements when setting up secondary press machines<br/>B2 Risk assessment</p> <p><b>Unit 5 Specialist engineering project</b></p> <p>B2 Risk and issues project management process processes</p> |                                                                         |
| 8             | Engineering design                 | <p><b>Fully covered in:</b></p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>A1 Design triggers<br/>A4 Designing for a customer<br/>A5 Regulatory constraints and opportunities<br/>A8 Manufacturing analysis<br/>B1 Design proposals<br/>B2 Communicating designs<br/>B3 Iterative development process</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |

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| 9             | Commercial aspects for engineering organisations | <p><b>Fully covered in:</b></p> <p><b>Unit 4 Applied commercial and quality principles in engineering</b></p> <p>A1 Business functions and key activities<br/> A2 Trade considerations<br/> A3 Competitive advantage<br/> C1 Quality systems</p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>A5 Regulatory constraints and opportunities<br/> A6 Market analysis</p> |                                                                         |

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| 10            | Properties and applications of engineering materials | <p><b>Fully covered in:</b></p> <p><b>Unit 25 Mechanical behaviour of metallic materials</b></p> <p>A1 Types of ferrous metals and alloys<br/> A2 Types of non-ferrous metals and alloys<br/> A3 Mechanical properties of metallic materials<br/> A4 Grain structure of metallic materials<br/> A5 Effects of processing on the mechanical properties of metallic materials<br/> A6 Microstructures investigation of metallic materials<br/> B2 Destructive test procedures<br/> C1 Ductile and brittle fracture<br/> C2 Creep failure<br/> C3 Fatigue failure</p> <p><b>Unit 26 Mechanical behaviour of non-metallic materials</b></p> <p>A1 Types of non-metallic materials<br/> A2 Structures of non-metallic materials<br/> A3 Mechanical properties of non-metallic materials<br/> B2 Destructive test procedures to determine mechanical properties<br/> B3 Material defects in non-metallic materials<br/> B4 Non-destructive tests used to identify material defects<br/> C1 Ductile and brittle fracture<br/> C2 Creep failure<br/> C3 Fatigue failure<br/> C4 Degradation processes</p> |                                                                         |

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|               |                                                | <p><b>Unit 13 Welding technology</b></p> <p>B1 The properties and behaviours of metallic materials<br/>           B2 Unalloyed steel materials<br/>           B3 Alloyed steel and non-ferrous materials</p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>A7 Performance analysis</p>                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |
| 11            | Further mechanical principles and applications | <p><b>Fully covered in:</b></p> <p><b>Unit 1 Mechanical principles</b></p> <p>B1 Static engineering systems<br/>           B2 Loaded components<br/>           C3 Angular parameters<br/>           C4 Lifting machines</p> <p><b>Unit 27 Static mechanical principles in practice</b></p> <p>A1 Static parameters<br/>           A2 Analysis of statically determinate framed structures<br/>           B1 Beam parameters</p> <p><b>Unit 28 Dynamic mechanical principles in practice</b></p> <p>A3 Rotational systems<br/>           B1 System parameters<br/>           B2 Rotating systems<br/>           B3 Dynamic balancing<br/>           C1 Parameters of lift machines<br/>           C2 Lifting machines</p> |                                                                         |

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| 12            | Applications of mechanical systems in engineering | <p><b>Fully covered in:</b></p> <p><b>Unit 24 Maintenance of mechanical systems</b></p> <p>A1 Lubrication characteristics<br/> A2 Lubrication of mechanical systems<br/> B1 Mechanical seal characteristics and common applications<br/> B2 Bearing characteristics and common applications<br/> B3 Fastener characteristics and common applications<br/> C1 Gear train function and operation in power transmission systems<br/> C2 Typical function and operation of other power transmission components</p> <p><b>Unit 12 Pneumatic and hydraulic systems</b></p> <p>A1 Hydraulic and pneumatic power supply components<br/> A2 Hydraulic and pneumatic actuator components<br/> A3 Hydraulic and pneumatic system control components<br/> A4 General system safety and maintenance</p> |                                                                         |

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| 15            | Electro, pneumatic and hydraulic systems and devices | <p><b>Fully covered in:</b></p> <p><b>Unit 12 Pneumatic and hydraulic systems</b></p> <p>A1 Hydraulic and pneumatic power supply components</p> <p>A2 Hydraulic and pneumatic actuator components</p> <p>A3 Hydraulic and pneumatic system control components</p> <p>A4 General system safety and maintenance</p> <p>B1 Creating hydraulic and pneumatic power circuit diagrams.</p> <p>B2 Simulating the operation of hydraulic and pneumatic power circuits</p> <p>C1 Health and safety requirements for the safe operation of hydraulic and pneumatic power systems</p> <p>C2 System assembly</p> <p>C3 Testing and fault finding hydraulic and pneumatic powered systems</p> |                                                                         |

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| 16            | Engineering drawing for technicians               | <p><b>Fully covered in:</b></p> <p><b>Unit 2 Delivery of engineering processes safely as a team</b></p> <p>B1 Principles of engineering drawing<br/> B2 2D computer aided drawing<br/> C4 Preparation activities for batch manufacture or batch service delivery</p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>B2 Communicating designs</p> <p><b>Unit 5 A specialist engineering project</b></p> <p>B4 Design information</p> <p><b>Unit 40 Computer aided manufacturing and planning</b></p> <p>B1 Model a component in preparation for manufacture<br/> C3 Product and/or component specification for manufacture</p> <p><b>Unit 19 Electronic devices and circuits</b></p> <p>A5 Schematic capture and simulation of analogue circuits<br/> B4 Schematic capture and simulation of digital circuits</p> |                                                                         |
| 19            | Mechanical measurements and inspection techniques | <p><b>Fully covered in:</b></p> <p><b>Unit 30 Mechanical measurement and inspection technology</b></p> <p>A1 Limits and fits<br/> A2 Tolerances<br/> B2 Types of mechanical measurement<br/> B3 Comparators<br/> B4 Gauging system<br/> B5 Component features, types and manufacturing processes<br/> C1 Principles of statistics<br/> C2 SPC procedure</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                         |

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| 23            | Welding technology             | <p><b>Fully covered in:</b></p> <p><b>Unit 13 Welding technology</b></p> <p>A1 Welding terminology for processes and equipment<br/> A2 Gas-shielded arc welding - shielding gases<br/> A3 Common welding processes<br/> A4 Welding electrotechnics<br/> B1 The properties and behaviours of metallic materials<br/> B2 Unalloyed steel materials<br/> B3 Alloyed steel and non-ferrous materials<br/> B4 Defects and irregularities in welded joints<br/> C1 Prepare for welding operations<br/> C2 Welding parameters and settings<br/> C3 Welding of joints safely</p> <p><b>Unit 2 Delivery of engineering processes safely as a team</b></p> <p>A2 Health and safety requirements<br/> C3 Health and safety risk assessment</p> <p><b>Unit 33 Fabrication manufacturing processes</b></p> <p>C3 Quality control procedures</p> |                                                                         |
| 24            | Industrial process measurement | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                         |

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| 27            | Welding principles | <p><b>Fully covered in:</b></p> <p><b>Unit 13 Welding technology</b></p> <p>A1 Welding terminology for processes and equipment<br/> A2 Gas-shielded arc welding - shielding gases<br/> A3 Common welding processes<br/> A4 Welding electrotechnics<br/> B2 Unalloyed steel materials<br/> B3 Alloyed steel and non-ferrous materials<br/> B4 Defects and irregularities in welded joints<br/> C1 Prepare for welding operations</p> <p><b>Unit 2 Delivery of engineering processes safely as a team</b></p> <p>A2 Health and safety requirements<br/> C3 Health and safety risk assessment</p> <p><b>Unit 33 Fabrication manufacturing processes</b></p> <p>C3 Quality control procedures</p> |                                                                         |

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| 28            | Further mathematics of engineering technicians (issue 2) | <p><b>Fully covered in:</b></p> <p><b>Unit 1 Mechanical principles</b></p> <p>A1 Algebraic methods<br/>A2 Trigonometric methods</p> <p><b>Unit 7 Calculus to solve engineering problems</b></p> <p>A2 Methods of differentiation<br/>B1 Integration as the reverse/inverse of differentiation<br/>B2 Integration as a summing tool<br/>B3 Numerical integration</p> <p><b>Unit 8 Further engineering mathematics</b></p> <p>A1 Arithmetic and geometric progressions<br/>C1 Complex numbers<br/>D1 Statistical techniques<br/>D2 Probability distributions<br/>D3 Statistical investigation</p> |                                                                         |

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| 29            | Mathematics for engineering technicians (Level 2 Unit) | <p><b>Fully covered in:</b></p> <p><b>Unit 1 Mechanical principles</b></p> <p>A1 Algebraic methods<br/>A2 Trigonometric methods</p> <p><b>Unit 3 Product design and manufacture in engineering</b></p> <p>A9 Statistical methods</p> <p><b>Unit 57 Electrical and electronic principles</b></p> <p>A3 Statistical methods</p> <p><b>Unit 7 Calculus to solve engineering problems</b></p> <p>A2 Methods of differentiation<br/>B1 Integration as the reverse/inverse of differentiation</p> |                                                                         |

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| 30            | Applied electrical and mechanical science for engineering (Level 2 Unit) | <p><b>Fully covered in:</b></p> <p><b>Unit 15 Electrical machines</b></p> <p>B2 Operation of DC motors and generators</p> <p><b>Unit 57 Electrical and electronic principles</b></p> <p>A3 Statistical methods<br/>           B1 Static and direct current electricity principles<br/>           B2 Direct current circuit theory<br/>           C1 Magnetism<br/>           C2 Electromagnetic induction</p> <p><b>Unit 27 Static mechanical principles in practice</b></p> <p>A1 Static parameters<br/>           A1 Dynamics of systems undergoing acceleration<br/>           A2 Linear systems</p> <p><b>Unit 29 Principles and applications of fluid mechanics</b></p> <p>A1 Properties and characteristics of fluids</p> |                                                                         |
| 35            | Principles and applications of electronic devices and circuits           | <p><b>Fully covered in:</b></p> <p><b>Unit 19 Electronic Devices and circuits</b></p> <p>A2 Diode devices and diode-based circuits<br/>           A3 Transistor devices and transistor-based circuits<br/>           A4 Operational amplifier circuits<br/>           A5 Schematic capture and simulation of analogue circuits<br/>           B1 Logic gates and Boolean algebra<br/>           B2 Combination logic circuits<br/>           B3 Sequential logic circuits<br/>           B4 Schematic capture and simulation of digital circuits<br/>           B5 Testing physical digital circuits</p>                                                                                                                        |                                                                         |

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| 44            | Engineering maintenance procedure and techniques      | <p><b>Fully covered in:</b></p> <p><b>Unit 11 Engineering maintenance and condition monitoring techniques</b></p> <p>A1 Types of maintenance and common maintenance techniques<br/> A2 Maintenance cost consideration<br/> A3 Reasons for maintenance<br/> B1 Condition monitoring techniques<br/> B2 Condition monitoring equipment and data<br/> B3 Principles and factors contributing towards potential faults and failures<br/> C1 Maintenance and condition monitoring plan<br/> C2 Health and safety requirements when undertaking maintenance activities</p>                                              |                                                                         |
| 45            | Monitoring and fault diagnosis of engineering systems | <p><b>Fully covered in:</b></p> <p><b>Unit 11 Engineering maintenance and condition monitoring techniques</b></p> <p>A1 Types of maintenance and common maintenance techniques<br/> A3 Reasons for maintenance<br/> C2 Health and safety requirements when undertaking maintenance activities<br/> B2 Condition monitoring equipment and data<br/> B3 Principles of and factors contributing towards potential faults and failures<br/> C2 Health and safety requirements when undertaking maintenance activities<br/> C3 Preparation for maintenance activities<br/> C4 Completion of a maintenance activity</p> |                                                                         |

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| 46            | Principles and applications of engineering measurement systems | <p><b>Fully covered in:</b></p> <p><b>Unit 21 Electronic measurement and testing of circuits</b></p> <p>A1 Operational features of typical measurement devices<br/> A2 Operational features of electronic test devices<br/> B1 Fault finding techniques<br/> B2 Preparation for testing and test plans<br/> C1 Safe working practice<br/> C2 Practical fault finding on analogue and digital circuits</p>                                                                              |                                                                                                                                                                                                                                                                                                        |
| 47            | Industrial plant and process control                           | <p><b>Partially covered in:</b></p> <p><b>Unit 11 Engineering maintenance and condition monitoring techniques</b></p> <p>B1 Condition monitoring techniques<br/> B2 Condition monitoring equipment and data<br/> B3 Principles and factors contributing towards potential faults and failures<br/> C1 Maintenance and condition monitoring plan</p> <p><b>Unit 43 Manufacturing computer numerical control machining processes</b></p> <p>A2 Open and closed loop feedback systems</p> | <p><b>Not covered:</b></p> <p>LO2 Know about common modes of control and their effect on control system performance<br/> LO3 Be able to apply tuning methods to three-term controllers to improve control system performance<br/> LO4 Understand hierarchical and advanced process control systems</p> |
| 48            | Function and characteristics of railway signalling systems     | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |
| 49            | Installing and commissioning engineering equipment             | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |

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| 50            | <b>Industrial process controllers</b> | <p><b>Fully covered in:</b></p> <p><b>Unit 35 Programmable logic controllers</b></p> <p>A1 Features and functions of programmable logic controllers<br/> A2 Programmable logic controller system hardware<br/> A3 Internal operation of programmable logic controllers<br/> B1 Integrated development environment (IDE)<br/> B2 Programming skills for programmable logic controllers<br/> B3 Test and debug programmable logic controller programmes</p>                                                                                                                                                                                                                                      |                                                                         |
| 51            | <b>Electrical technology</b>          | <p><b>Fully covered in:</b></p> <p><b>Unit 2 Product design and manufacture in engineering</b></p> <p>B4 Material properties<br/> B5 Mechanical power transmission</p> <p><b>Unit 15 Electrical machines</b></p> <p>B1 Operation of DC motors and generators</p> <p><b>Unit 16 Three phase electrical systems</b></p> <p>A2 Transmission and distribution networks</p> <p><b>Unit 17 Power and energy electronics</b></p> <p>C1 Applications of power electronics</p> <p><b>Unit 18 Electrical power distribution and transmission</b></p> <p>A1 Thermal power generation<br/> A2 Nuclear power generation<br/> B1 Transmission networks<br/> C1 Network design<br/> C2 Power distribution</p> |                                                                         |

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| 52            | Electrical installation            | <p><b>Fully covered in:</b></p> <p><b>Unit 14 Electrical installation of hardware and cables</b></p> <p>A3 Reducing the risk of electrical shock<br/> A4 Circuit protection methods<br/> B1 Lighting circuits for domestic installations<br/> B2 Power circuits for domestic installations<br/> B3 Circuits for commercial installations<br/> C1 Cables<br/> C2 Connectors<br/> C3 Wiring enclosures<br/> D1 Safe working practices<br/> D2 Safe working procedures<br/> D3 Circuits testing</p>                                                                         |                                                                         |
| 53            | Electronic measurement and testing | <p><b>Fully covered in:</b></p> <p><b>Unit 21 Electronic measurement and testing of circuits</b></p> <p>A1 Operational features of typical measurements devices<br/> A2 Operational features of electronic test devices<br/> B1 Fault finding techniques<br/> B2 Preparation for testing and test plans<br/> C1 Safe working practice<br/> C2 Practical fault finding on analogue and digital circuits</p> <p><b>Unit 15 Electrical machines</b></p> <p>B1 Function and operation of electrical test meters<br/> C1 Function and operation of electrical test meters</p> |                                                                         |

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| No.           | Title                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                         |
| 54            | Monitoring and analysing engineering activities     | <p><b>Fully covered in:</b></p> <p><b>Unit 39 Modern manufacturing systems</b></p> <p>A1 Manufacturing operations<br/> A2 Performance objectives in manufacturing operations<br/> B1 Process types and typical industrial applications<br/> B2 Manufacturing layout types<br/> B3 Characteristics of effective system layout<br/> B4 Manufacturing documentation</p> <p><b>Unit 41 Manufacturing secondary machining processes</b></p> <p>B1 Health and safety requirements when setting up secondary press machines<br/> B2 Risk assessment</p> <p><b>Unit 5 Specialist engineering project</b></p> <p>B2 Risk and issues project management process processes</p> |                                                                         |
| 55            | Railway signalling systems testing and maintenance  | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |
| 56            | Railway infrastructure construction and maintenance | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |

| 2010 QCF Unit |                                          | International BTEC Level 3 unit to which 2010 unit relates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Areas of content in the 2010 unit not covered in the International unit |
|---------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| No.           | Title                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                         |
| 148           | Process safety management in engineering | <p><b>Fully covered in:</b></p> <p><b>Unit 2 Delivery of engineering processes safety as a team</b></p> <p>A2 Health and safety requirements<br/>C3 Health and safety risk assessment</p> <p><b>Unit 41 Manufacturing secondary machining processes</b></p> <p>B1 Health and safety requirements when setting up secondary press machines<br/>B2 Risk assessment</p> <p><b>Unit 5 Specialist engineering project</b></p> <p>B2 Risk and issues project management process processes</p> <p><b>Unit 11 Engineering maintenance and condition monitoring techniques</b></p> <p>A1 Types of maintenance and common maintenance techniques<br/>B1 Condition monitoring techniques<br/>B3 Principles of and factors contributing towards potential faults and failures</p> |                                                                         |

## BTEC International Level 3 units not mappable to QCF qualification

| International Unit Number | International Unit Name                  |
|---------------------------|------------------------------------------|
| 33                        | Computer systems security                |
| 34                        | Computer systems support and performance |
| 37                        | Computer networks                        |
| 38                        | Website production to control devices    |