

## Higher National Unit Specification

### General information for centres

**Unit title:** Maintenance and Quality Assurance in Building Services

**Unit code:** DP18 34

**Unit purpose:** The purpose of this unit is to identify the need for quality assurance procedures during the design, installation and operation of building services systems.

On completion of the Unit the candidate should be able to:

- ◆ Describe the **quality standards and strategies** appropriate to the building services system design and installation activities.
- ◆ Explain **maintenance strategies** and their impact on design and installation activities.
- ◆ Determine **design activities, data and procedures** required to ensure effective testing, setting to work and commissioning of building services systems.
- ◆ Evaluate **completion and ‘hand-over’ requirements** in accordance with contract conditions.

**Credit points and level:** 1 HN Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** It would be an advantage for candidates to have a basic understanding and knowledge of building services engineering science and technology. Such understanding and knowledge may be evidenced by the possession of a National Certificate in Building Services Engineering or a related subject. The unit includes all the basic principles necessary to allow candidates possessing other qualifications or experience to succeed in this unit.

**Core skills:** There may be opportunities to gather evidence towards core skills in this Unit, although there is no automatic certification of core skills or core skills components.

**Context for delivery:** This unit was developed for the HNC in Building Services Engineering. If this Unit is delivered as part of another group award (s), it is recommended that it should be taught and assessed within the context of the group award (s) to which it contributes.

**Assessment:** It is possible to assess candidates either on an individual Outcome basis, combinations of Outcomes or by a single holistic assessment combining all Outcomes. The assessment paper/s should be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be conducted under supervised, controlled conditions. A single assessment covering all outcomes should not exceed 2 hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

## **General information for centres (cont)**

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

## Higher National Unit specification: statement of standards

**Unit title:** Maintenance and Quality Assurance in Building Services

**Unit code:** DP18 34

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

(If you think holistic assessment is the best assessment strategy for the Unit and you wish to state *Knowledge and/or Skills* and *Evidence requirements* for the Unit as a whole, please add the following statement here: ‘Please refer to *Knowledge and/or skills for the Unit* and *Evidence requirements for the Unit* after the Outcomes.’)

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Describe the **quality standards and strategies** appropriate to the building services system design and installation activities.

#### Knowledge and/or skills

- ◆ Define quality
- ◆ The need for a quality culture
- ◆ Quality plans as an expression of practices
- ◆ Quality standards and safety factors
- ◆ Explain responsibility for quality
- ◆ Contractual quality criteria
- ◆ Quality assurance procedures and processes

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ produce a ‘quality statement’
- ◆ describe essential elements of a quality culture
- ◆ produce a quality plan
- ◆ identify quality and safety standards and explain their implications
- ◆ develop appropriate quality assurance processes and procedures
- ◆ explain the importance of quality for commercial success

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **four out of seven** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items.

## Higher National Unit specification: statement of standards (cont)

### Unit title: Maintenance and Quality Assurance in Building Services

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

#### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 2, 3, 4 to form a single assessment paper.

### Outcome 2

Explain **maintenance strategies** and their impact on design and installation activities.

#### Knowledge and/or skills

- ◆ Responsibilities in the operation and maintenance of building services
- ◆ Maintenance techniques and their applications
- ◆ Maintenance Contracts
- ◆ Maintenance strategy and control
- ◆ Implications of maintenance strategy on the design and installation process
- ◆ Techniques for maintenance audits
- ◆ Application of CDM Regulations

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ define areas of responsibilities within building services maintenance
- ◆ explain the types of maintenance available
- ◆ evaluate the merits of the various forms of maintenance contract
- ◆ explain the factors that influence maintenance strategy
- ◆ evaluate implications for the design and installation process
- ◆ produce solutions to identifiable risks
- ◆ produce a sample maintenance audit

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **four out of seven** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Maintenance and Quality Assurance in Building Services

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 3, 4 to form a single assessment paper.

### Outcome 3

Determine **design activities, data and procedures** required to ensure effective testing, setting to work and commissioning of building services systems.

#### Knowledge and/or skills

- ◆ Identification of test requirements and procedures
- ◆ Setting-to-work plans for plant and equipment
- ◆ The requirements for commissioning systems to meet design criteria
- ◆ Responsibility of testing and commissioning
- ◆ Methods of measuring, regulating and balancing building services systems
- ◆ Documenting testing and commissioning data / results
- ◆ Decommissioning

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify test requirements and procedures
- ◆ explain implications for design and installation procedure
- ◆ define responsibilities of the commissioning specialist(s)
- ◆ define the design engineer's responsibilities with respect to testing and commissioning
- ◆ develop setting-to-work and commissioning plans for plant equipment and systems
- ◆ describe methods of measuring, regulating & balancing building services systems
- ◆ identify the documentation to be submitted at Practical Completion
- ◆ procedures for decommissioning

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **four out of seven** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

## Higher National Unit specification: statement of standards (cont)

### Unit title: Maintenance and Quality Assurance in Building Services

The assessment for this outcome might be combined with that for Outcomes 1, 2, 4 to form a single assessment paper.

### Outcome 4

Evaluate **completion and 'hand-over' requirements** in accordance with contract conditions.

#### Knowledge and/or skills

- ◆ Contractual requirements for project completion
- ◆ Information required by the client upon Practical Completion
- ◆ Implications of Practical Completion
- ◆ Handover procedures
- ◆ Operation and maintenance manuals
- ◆ Health and Safety file
- ◆ User training
- ◆ Designer and Contractor post contract responsibilities

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify and describe contractual requirements
- ◆ explain the importance of Practical Completion
- ◆ duties of responsibilities after Practical Completion
- ◆ develop an appropriate 'hand-over' plan
- ◆ explain the requirement of operation and maintenance manuals
- ◆ explain the requirement for the Health and Safety file
- ◆ the importance of user training
- ◆ identify and describe post contract responsibilities for both design engineer and contractor.
- ◆ the importance of the Defect and Liability period

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **four out of eight** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

#### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 2, 3 to form a single assessment paper.

## **Administrative Information**

<b>Unit code:</b>	DP18 34
<b>Unit title:</b>	Maintenance and Quality Assurance in Building Services
<b>Superclass category:</b>	TH
<b>Date of publication:</b>	August 2005
<b>Version:</b>	01
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## Higher National Unit specification: support notes

### Unit title: Maintenance and Quality Assurance in Building Services

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### Guidance on the content and context for this Unit

This unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas;

- ◆ Describe the quality standards and strategies appropriate to the building services system design and installation activities.
- ◆ Explain maintenance strategies and their impact on design and installation activities.
- ◆ Determine design activities, data and procedures required to ensure effective testing, setting to work and commissioning of building services systems.
- ◆ Evaluate completion and 'hand-over' requirements in accordance with contract conditions.

Recommended time allocations to each outcome are given as guidance towards the depth of treatment which might be applied to each topic. This guidance has been used in the design of the assessment exemplar material provided with the unit.

#### 1. Describe the quality standards and strategies appropriate to the building services system design and installation activities. (10 hours)

##### Define quality

##### The need for a quality culture

##### Quality plans as an expression of practices

- Quality management
- Quality Assurance
- Quality Control
- Inspection
- Total Quality Management (TQM)
- People, Systems and Technology

##### Quality standards and safety factors

- Quality standards – BS EN ISO 9000 series of standards
- The benefits of BS EN ISO 9000
- British Standards, European Standards, International Standards

##### Explain responsibility for quality

- Employee and Employer responsibilities

##### Contractual quality criteria

- Explicit and implicit quality practices
- Reference to contractual documents; bill of quantities, specification and drawings



## **Higher National Unit specification: support notes (cont)**

**Unit title:** Maintenance and Quality Assurance in Building Services

### **Quality assurance procedures and processes**

The seven tools of quality control

Flowcharts, Check sheets, Pareto diagrams, Cause and Effect diagrams, Histograms, Scatter diagrams and Control charts

Monitoring of services installation against the specification

Monitoring maintenance performance – service delivery

## **2. Explain maintenance strategies and their impact on design and installation activities. (10 hours)**

### **Responsibilities in the operation and maintenance of building services**

The design engineer's responsibilities

Establishing client's requirements

Advising the client

Environmental responsibility during installation selection and future maintenance regime

### **Maintenance techniques and their applications**

The management of maintenance

Options and types of maintenance available

Assessment of maintenance types

Maintenance policy and strategy

### **Maintenance Contracts**

Components of contract documents

Types of maintenance contract available

### **Maintenance strategy and control**

Maintenance strategy

The design stage

The operational stage

Effective control via system and performance audit

Use of quality management to establish responsibility, procedures and reporting formats

### **Implications of maintenance strategy on the design and installation process**

#### **Techniques for maintenance audits**

Auditing maintenance contract performance

Use of a qualitative scoring method

Audit procedure

#### **Application of CDM Regulations**

Identifying risks and methods of managing risks with respect to maintenance requirements

## Higher National Unit specification: support notes (cont)

**Unit title:** Maintenance and Quality Assurance in Building Services

3. **Determine design activities, data and procedures required to ensure effective testing, setting to work and commissioning of building services systems. (10 hours)**

### **Identification of test requirements and procedures**

The importance of designing provision for testing (reference to CDM Regulations)

Identification and reference made to relevant guidance documents/publications e.g. British Standards, Approved Codes of Practice, HVCA, and British Standards etc covering the following;

Air Distribution systems including Ventilation & Air Conditioning

Hot & Cold Water Services

LPHW, MPHW Heating Systems

Refrigeration Plant

Gas Installations

Automatic Controls and Associated Systems

### **Setting-to-work plans for plant and equipment**

Importance of a controlled logical programme of events covering the initial operation of plant & equipment.

### **The requirements for commissioning systems to meet design criteria**

CIBSE Commissioning Codes A, B, C, R and W.

Implication on system performance

Importance of provision for commissioning at design stage

### **Responsibility of testing and commissioning**

Design engineer, contractor and specialist commissioning agent

Areas of responsibility; Electrical and mechanical services, control systems and specialist equipment e.g. lifts fire alarms etc

Commissioning scope of works

### **Methods of measuring, regulating and balancing building services systems**

Specification/selection of appropriate metering equipment for installation

Orifice Plates

Venturi

Pitot Tubes

Design provision for desirable metering stations within the systems

Proportional Balancing of water & air systems

### **Documenting testing and commissioning data / results**

Witnessing testing/commissioning

Production of design values referenced to installation drawings

Responsibility for the commissioning and testing of system and associated plant and equipment

Evaluating commissioning results

Operating and Maintenance Manuals (CDM Regulations)

## **Higher National Unit specification: support notes (cont)**

**Unit title:** Maintenance and Quality Assurance in Building Services

### **Decommissioning**

Decommissioning procedures

4. **Evaluate completion and ‘hand-over’ requirements in accordance with contract conditions. (10 hours)**

### **Contractual requirements for project completion**

Installation complete to the satisfaction of the project supervisor

Mechanical services systems fully commissioned and operational

### **Information required by the client upon Practical Completion**

Operation and maintenance manuals (H&S file)

Complete set of testing and commissioning results

As fitted drawings etc

### **Implications of Practical Completion**

Definition of Practical Completion

Financial implications

Commencement of defects and liability period

Client possession

Contractors’ contractual responsibilities

Design professional duty of care responsibilities

### **Handover procedures**

Preparation for handover proceedings – checklist

Inspection and identifying defects

User training – client nominated

### **Operation and maintenance manuals**

Requirement under CDM regulations

Contents (reference to BSRIA)

### **Health and Safety file**

Requirement under CDM regulations

Contents of H&S file

### **User training**

### **Designer and Contractor post contract responsibilities**

## **Higher National Unit specification: support notes (cont)**

**Unit title:** Maintenance and Quality Assurance in Building Services

### **Guidance on the delivery and assessment of this Unit**

#### ***Opportunities for developing Core Skills***

This Unit links with all other technical units in the award and as such may be delivered as a standalone package or integrated with other units.

It is recommended that evidence for learning outcomes is achieved through well-planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each candidate, group work and role-play activities may contribute to the assessment. Integrative assignments and project work will help to link this unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme.

In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills units.

Where available, evidence from the workplace can also be incorporated to enhance the learning outcomes, provided that this evidence is appropriate and authenticated as the candidate's own work.

#### **Open learning**

Given that appropriate materials exist this unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment/s were conducted under controlled, supervised conditions.

#### **Candidates with additional support needs**

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website [www.sqa.org.uk](http://www.sqa.org.uk)

## **General information for candidates**

### **Unit title:** Maintenance and Quality Assurance in Building Services

On completion of the Unit you should be able to:

- ◆ Describe the quality standards and strategies appropriate to the building services system design and installation activities.
- ◆ Explain maintenance strategies and their impact on design and installation activities.
- ◆ Determine design activities, data and procedures required to ensure effective testing, setting to work and commissioning of building services systems.
- ◆ Evaluate completion and 'hand-over' requirements in accordance with contract conditions.

Evidence that you can satisfy the knowledge and skill elements of this unit will be obtained by assessment in controlled, supervised conditions to which you will not be allowed to bring textbooks, handouts or notes to the assessment.