Higher National Unit Specification

General information for centres

Unit title: Electricity and Lighting

Unit code: DP0R 34

Unit purpose: The aim of this unit is to provide the candidate with a **broad understanding** of electrical power and lighting services. The purpose of the unit is to promote a better understanding of commercial electrical services installations **for candidates following predominantly mechanical building services options**.

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

- Investigate the design and installation requirements of **simple lighting applications**
- Evaluate the methods of **electrical distribution** for commercial, public and industrial buildings
- Apply **legislation and standards for electrical installations** to mechanical loads
- Investigate the selection, operation and application of **motors and control installations** for mechanical building services plant.

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 Building Services Engineering. If this Unit is delivered as part of another group award, it is recommended that it should be taught and assessed within the subject area of the group award(s) to which it contributes.

General information for centres (cont)

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.

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: Electricity and Lighting

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

Investigate the design and installation requirements of **simple lighting applications**

Knowledge and/or skills

- Lamps and luminaries
- Energy requirements for lighting installations
- Lighting layouts and supply circuits
- Controlling lighting installations
- Emergency lighting installations

Evidence requirements

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

- select appropriate lamps and luminaries for various applications and environments
- compare lighting installations for their efficacy and compliance with energy requirements
- understand lighting layouts and supply circuits for general and emergency lighting applications
- select methods of controlling lighting installations

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 **three out of four** 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 three 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. This assessment might be based on a case study.

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

Outcome 2

Evaluate the methods of **electrical distribution** for commercial, public and industrial buildings

Knowledge and/or skills

- Types of load
- Alternative power supplies
- UPS systems
- Methods of electrical distribution
- Types of cable

Evidence requirements

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

- identify types of load
- evaluate the suitability and cost effectiveness of alternative power supplies
- understand the applications, characteristics and features of UPS systems
- compare the methods of electrical distribution commonly used within commercial and industrial buildings
- select appropriate types of cable and methods of electrical distribution.

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 **three out of five** 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 three 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. This assessment might be based on a case study.

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

Higher National Unit specification: statement of standards (cont)

Unit title: Electricity and Lighting

Outcome 3

Apply **legislation and standards for electrical installations** to mechanical loads

Knowledge and/or skills

- Legislation and standards
- Protection against shock
- Cable sizing
- Circuit protection devices
- Assessing electrical load.
- Discrimination
- Assessing electrical load

Evidence requirements

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

- evaluate the application of relevant legislation and standards for given electrical installations
- explain the principles, procedures and equipment used in electrical installations to protect against shock
- determine appropriateness of cable sizes using electrical tables and calculations
- describe operating characteristic for over current/short circuit protection devices
- determine discrimination exists
- apply calculations for assessing electrical load.

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 **five 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 five 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. This assessment might be based on a case study.

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

Higher National Unit specification: statement of standards (cont)

Unit title: Electricity and Lighting

Outcome 4

Investigate the selection, operation and application of **motors and control installations** for mechanical building services plant

Knowledge and/or skills

- DC and AC motors
- Motor control methods
- Electrical aspects of building services control installations and panels

Evidence requirements

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

- compare the operating characteristics of ac and dc motors
- evaluate the suitability of ac and dc motors and their control for the efficiency for Building Services systems
- identify the design and installation requirements for simple electrical panel installations
- interpret schematic wiring diagram for a building services installation control panels.

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 **two out of three** 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 both 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. This assessment might be based on a case study.

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

Administrative Information

Unit code:	DP0R 34
Unit title:	Electricity and Lighting
Superclass category:	TH
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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Electricity and Lighting

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 is intended to develop a candidate's understanding of electrical installations and systems. The unit is intended **to increase the breadth of knowledge for those candidates who are primarily involved in the design and installation of mechanical building services installations** in commercial buildings. It is not intended to provide the depth of knowledge required by candidates who are following the specialist electrical installation options.

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. **Simple lighting applications (8 Hours)**

   General Lighting: lighting terms and units, essentials for good quality lighting, selection of appropriate levels of illuminance. Glare and its control. Characteristics and application of lamps in common use. Use of photometry data. Design of lighting layout by Lumen method. Legislation and Industrial Standards

   Energy efficiency: requirements, luminaries output, control, green issues, Legislation

   Emergency Lighting: maintained, Non-Maintained, lighting levels, positioning, escape routes, maintenance and testing requirements, Legislation and Industrial Standards

2 **Electrical distribution (12 hours)**

   Types of Load: essential, critical and non-essential loads

   Alternative supplies: single and multi-sets installations, automatic start arrangements, synchronisation with other sets or the public supply, Prime movers, fuel, efficiency Legislation and Regulations

   UPS systems: central, local, single-phase, three-phase, three phase - single phase. Static switch/by-pass

   Distribution: rising mains, sub-main, bus-bar, trunking, conduit, false floor systems, ducting, types of cables. Category of Circuits

3 **Legislation and standards for electrical installations (12 hours)**

   IEE Regulations relationship with statutory regulations: Current Electrical Supply Regulations, Health & Safety at Work Legislation, Electricity at work regulations, The Building Regulations, CDM Regulations, The Electromagnetic Compatibility Regulations.

Fundamental requirements for safety: principles of earthing, protective conductors, bonding, supplementary bonding, circuit protective conductor, determination of size, Residual Current Devices

Over current protection: overload devices, short circuit and overload protection, discrimination.

Cable Ratings: method of installation, correction factors, determination of cable ratings for mechanical loads.

4 Motors and control installations (8 hours)

DC Motor principles: electromagnetic forces, Series/shunt motors, Speed/Torque characteristics, Starting methods, Speed Control, efficiency

AC Motor principles: induction/synchronous motor principles and characteristics. Speed/Torque characteristics. Starting methods – Inverter, Soft-start, DOL, Star Delta, Speed Control

Alternative motor control strategies including inverters.

Motor selection & ratings: enclosures, Classes, ratings, theoretical ratings

Electrical Aspects of Control Installations: plant and control schematics and circuit diagrams. Control strategy, flow and logic diagrams. Block wiring diagrams. Control panel and field wiring diagrams, Relay Logic.

Guidance on the delivery and assessment of this Unit

Opportunities for developing Core Skills

This unit could be delivered as a standalone package, but may be integrated with other aspects of the HVAC or Plumbing units to produce a more holistic approach to building services.

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.

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.

Higher National Unit specification: support notes (cont)

Unit title: Electricity and Lighting

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

General information for candidates

Unit title: Electricity and Lighting

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

- Investigate the design and installation requirements of **simple lighting applications**
- Evaluate the methods of **electrical distribution** for commercial, public and industrial buildings
- Apply **legislation and standards for electrical installations** to mechanical loads
- Investigate the selection, operation and application of **motors and control installations** for mechanical building services plant.

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.