National Unit Specification: general information

UNIT Electrical and Electronic Technology (SCQF level 5)

CODE F1AN 11

SUMMARY

This Unit is suitable for candidates who:

- are undertaking the study of this subject for the first time or
- wish to obtain a basic knowledge of Electrical and Electronic Technology

The aim of this Unit is to enable candidates in the Building Services Engineering industry to develop their knowledge and understanding of the electrical engineering principles which form the basis of control systems.

The Unit will also enable candidates to gain sufficient knowledge, understanding and skills to solve simple electrical network problems. Candidates will also be introduced to circuit control devices and will develop a basic knowledge and understanding of open and closed-loop control systems used in the control of building services.

OUTCOMES

1 Solve electrical network problems in a Building Services Engineering environment.
2 Identify circuit control devices and explain their function in a Building Services Engineering environment.
3 Explain the operation of basic control circuits in a Building Services Engineering environment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- Standard Grade Physics, Technological Studies or Science at General level

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Administrative Information

Superclass: XJ

Publication date: December 2012

Source: Scottish Qualifications Authority

Version: 02

National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*)

**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.*

6 credit points indicates a notional Unit design length of 40 hours of contact and 20 hours of self-directed learning

CORE SKILLS

There is no automatic certification of Core Skills in this Unit however the Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- Numeracy (SCQF level 5)
- Problem Solving (SCQF level 5)

National Unit Specification: statement of standards

UNIT Electrical and Electronic Technology (SCQF level 5)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority. Appendix One forms a part of this statement of standards.

OUTCOME 1

Solve electrical network problems in a Building Services Engineering environment.

Performance Criteria

(a) Reduce correctly a direct current (dc) network, comprising of a minimum of six resistances in a series-parallel combination, to an equivalent single resistance.
(b) Calculate accurately the voltage, current and power quantities in a dc network.
(c) Sketch clearly a single-phase sinusoidal voltage waveform and identify correctly its peak value, peak-to-peak value and periodic time.
(d) Calculate accurately the frequency and Root Mean Squared (RMS) values of a sinusoidal current waveform.
(e) Calculate accurately the inductive reactance of a circuit connected to a sinusoidal supply voltage.
(f) Calculate accurately the current and voltage drops in a circuit consisting of a resistance and inductance connected in series and supplied from a single-phase, sinusoidal source.

OUTCOME 2

Identify circuit control devices and explain their function in a Building Services Engineering environment.

Performance Criteria

(a) Identify correctly room thermostats, programmable thermostats, temperature controllers, motorised valves, time switches and programmer Units.
(b) Explain clearly the function of room thermostats, programmable thermostats, temperature controllers, motorised valves, time switches and programmer Units.

OUTCOME 3

Explain the operation of basic control circuits in a Building Services Engineering environment.

Performance Criteria

(a) Explain clearly the need for control of heating, ventilation and air conditioning systems.
(b) Explain clearly the operation of open and closed loop control systems.
(c) Identify correctly the component parts of a control circuit for a central heating system.
(d) Explain clearly the operation of the control circuit for a central heating system.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

The appendix to this Unit details the mandatory content for each Outcome.

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

In every assessment of Outcomes 1, 2 and 3, **all** Performance Criteria must be assessed.

Candidates must show sufficient evidence in the assessment of the Performance Criteria specified for each Outcome in order to pass this Unit.

For Outcomes 1, 2, 3, 4 and 5 written and/or oral evidence must be produced in controlled, supervised, closed-book conditions. In this Unit an appropriate instrument of assessment could be a question paper consisting of a balance of multiple choice, short answer, restricted response and structured questions. Candidates must not bring notes, textbooks or handouts to the assessment.

Candidates may be assessed on an Outcome by Outcome basis, combinations of Outcomes or by a single, holistic assessment covering Outcomes 1, 2, and 3.

Assessments must be manageable and practicable for candidates and centres. The recommended assessment time for each Outcome should be:

- Outcome 1 – 0.75 hour
- Outcome 2 – 0.5 hour
- Outcome 3 – 0.75 hour

Total assessment time – 2 hours

National Unit Specification: support notes

UNIT Electrical and Electronic Technology (SCQF level 5)

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

The appendix to this Unit details the mandatory content for each Outcome.

This Unit is a mandatory Unit within the National Certificate in *Building Services Engineering* level 6.

The aim of this Unit is to enable candidates to develop their knowledge and understanding of the electrical engineering principles which form the basis of control systems. The Unit will also enable candidates to gain sufficient knowledge, understanding and skills to solve simple electrical network problems. Candidates will also be introduced to circuit control devices and will develop a basic knowledge and understanding of open and closed-loop control systems used in the control of building services.

Health and Safety and Sustainability are integral and key to the Building Services Engineering industry therefore throughout the Unit emphasis should be placed where appropriate on the application of Health and Safety and Sustainability. Safe working practices should be looked at in accordance with current safety codes of practise and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Where this Unit is delivered as part of the National Certificate in *Building Services Engineering* (SCQF level 6).The Unit has links with the technology Units in the National Certificate in Building Services Engineering award; it is recommended that it be delivered after or in parallel with these Units. For example:

- *Air Conditioning and Ventilation Technology* (SCQF level 6)
- *Refrigeration Technology* (SCQF level 6)
- *Heating and Plumbing Technology* (SCQF level 6)
- *Building Services Engineering Technology* (SCQF level 5)

Delivery of the Unit should emphasise familiarisation with terminology and basic electrical and control concepts and principles rather than detailed analytical studies.

The delivery should be based on a practical approach where possible and should expose candidates to the actual components and circuitry used in control applications. Learning and teaching approaches should include demonstration and practice which will provide candidates with opportunities to construct control circuits and thus gain an understanding of the interpretation of such circuitry and their operation.

National Unit Specification: support notes (cont)

UNIT Electrical and Electronic Technology (SCQF level 5)

Practical work should be emphasised to allow candidates to confirm concepts and principles in practice and to learn important electrical skills such as interpreting circuit/wiring diagrams, wiring up circuits, using test equipment and interpreting the test results.

Case studies and project work may be used to develop a range of control applications which will allow candidates to appreciate the wider use of control principles and concepts developed in this Unit.

Opportunities for developing Core Skills

Accuracy in interpreting graphic information and the ability to calculate, apply and present complex data is an aspect of best practice across the Building Services award. Numeracy involves a wide range of skills which underpin a flexible, practical approach to building services technology. These should be identified, encouraged and developed as candidates undertake the Unit through well-planned course work, assignments and projects.

Individual and group discussion with assessor support could develop elements of problem solving skills, with discussion of all factors impacting on planning and implementing electrical and control applications. Analytical discussion of case studies would provide a stimulus to creative thinking and a guide to best practice. The emphasis should be on Numeracy as a tool to be used and applied efficiently and critically, and on evaluation of factors such as health and safety on electrical technology. Integrative assignments and project work involving related Units will help to develop practical skills in the context of workplace practice.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

To be read in conjunction with the **Evidence Requirements**.

Candidates may be assessed on an Outcome by Outcome basis, combinations of Outcomes or by a single, holistic assessment covering Outcomes 1, 2 and 3.

In this Unit an appropriate instrument of assessment could be a question paper consisting of a balance of multiple choice, short answer, restricted response and structured questions.

Preparation for assessment should include formative work with opportunities for constructive feedback. Well planned assignments and project work will also be useful preparation.

Where the Unit is taken as part of the National Certificate in Building Services Engineering, there may be opportunities to integrate the assessments for this Unit with other appropriate Units. For example:

- *Air Conditioning and Ventilation Technology* (SCQF level 6)
- *Refrigeration Technology* (SCQF level 6)
- *Heating and Plumbing Technology* (SCQF level 6)
- *Building Services Engineering Technology* (SCQF level 5)

Planning should allow time for re-assessment. Given that assessment for this Unit must be conducted in controlled conditions, centres should ensure that a different assessment is given for re-assessment purposes and that similar controlled conditions apply.

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 DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

Appendix

National Unit Specification: statement of standards

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APPENDIX: CONTENT AND CONTEXT FOR THIS UNIT

This appendix is within the statement of standards, ie the mandatory requirements of the Unit.

Recommended time allocations for each Outcome are given as guidance towards the depth of treatment which might be applied to each topic and are inclusive of time teaching, learning and assessment.

1 Solve electrical network problems in a Building Services Engineering environment (14 hours).

- Electrical quantities: charge, current, voltage, emf and resistance
- Ohm's and Kirchhoff's Laws
- Resistances in series, parallel and series — parallel
- DC network problems
- Generation of a single phase sinusoidal waveform
- Key parameters of single-phase sinusoidal waveforms: peak value, peak to peak values, periodic time, frequency and RMS values
- Inductive Reactance and Impedance
- AC circuit problems for R and L in series

2 Identify circuit control devices and explain their function in a Building Services Engineering environment (8 hours).

- The need for control devices in building service applications
- Identification of: room thermostats, programmable thermostats, temperature controllers, motorised valves, time switches, programmer Units.
- Function of: room thermostats, programmable thermostats, temperature controllers, motorised valves, time switches, programmer Units.

3 Explain the operation of basic control circuits in a Building Services Engineering environment (18 hours).

- The need to incorporate control devices into circuits for the control of heating, ventilation, air conditioning and other building services
- The operation and characteristics of open and closed loop control systems
- Familiarisation with control circuits and the function of the various component parts of these
- Operation of practical control circuitry (a central heating system may be used as an example for this exercise)

History of changes:

Version	Description of change	Date
02	Reference to The Assessment Support Pack on page 4 removed.	03/12/2012