National Unit Specification: general information

UNIT Basic Electrical Installation Systems and Protection (Intermediate 2)

NUMBER D9AG 11

COURSE Electrical Installation Fundamentals (Intermediate 2)

SUMMARY

This unit has been designed to introduce candidates to the basic electrical installation circuit and the protection of electrical circuits. It gives an overall appreciation of the generation and supply of electrical energy and indicates typical values of generation and transmission voltages. Typical types of circuit protection devices are identified and an appreciation of the dangers and risks associated with the use of electricity. Wiring arrangements are interpreted for various lighting and power circuits.

OUTCOMES

1 Identify the stages of transfer of electrical energy.
2 Identify the types of protective devices used for overload and short circuit protection.
3 Interpret electrical circuit diagrams for 1 way and 2 way switching for lighting circuits and radial power circuits.

RECOMMENDED ENTRY

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

- Mathematics and either Technological Studies or Physics at Grade 3 and 4 (General level) Standard Grade
  OR
- Equivalent National Units

Administrative Information

Superclass: XJ

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CREDIT VALUE
1 credit at Intermediate 2 (6 SCOTCAT points*) at SCQF level 5.

**SCOTCAT 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 SCOTCAT points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS
There is no automatic certification of core skills or core skills components in this unit.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Basic Electrical Installation Systems and Protection (Intermediate 2)

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.

OUTCOME 1
Identify the stages of transfer of electrical energy.

Performance criteria
a) A knowledge of the nature of the generation of ac waveforms and their significant values is correctly displayed.
b) A knowledge of the National Grid System is correctly displayed.
c) The voltages for all the stages from generation through to the customer's installation are correctly produced.
d) The arrangements of control gear for a domestic installation consumer's intake position are accurately sketched.
e) The function of each component of the intake position equipment is correctly stated.
f) The purpose of earthing within an electrical installation is clearly described.

Evidence requirements
The candidate could be given a graphical/written, objective/short answer exercise where the candidate displays an understanding of the generation of ac waveforms, its r.m.s. and peak values and demonstrates the ability to calculate the frequency of the waveform. A knowledge of the National Grid System and the order and voltages of the stages to the consumer will be accurately determined. The candidate will also be asked to identify the order of a consumer's intake position equipment and to explain the function of each piece of equipment shown in a given diagram.

Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

OUTCOME 2
Identify the types of protective devices used for overload and short circuit protection.

Performance criteria
a) The dangers of electricity are clearly recognised.
b) The types of over-currents that can occur within electrical installations and their associated dangers are correctly identified.
c) The term earth fault current is correctly explained.
d) Devices used in electrical installations to protect against over-current and earth fault currents are correctly identified.

National Unit Specification: statement of standards (cont)

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Evidence requirements

The candidate could be given an objective type exercise or a structured question to test the comprehension of the types, causes and dangers associated with over-currents, the types of over-current and shock protection devices.

One of the questions will ask the candidate to recognise a number of different types of protective devices. To achieve this part, the centre must supply the following devices for the candidate to physically handle. These are: miniature circuit-breaker, cartridge fuse holder and residual current device.

Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

OUTCOME 3

Interpret electrical circuit diagrams for 1 way and 2 way switching for lighting circuits and radial power circuits.

Performance criteria

a) The wiring arrangements for a 1 way and 2 way lighting circuit, using the loop-in and joint box wiring methods, are drawn using the correct colour codes for cables and are labelled correctly with standard cable sizes and protective device which conform to accepted standards.

b) The wiring arrangement for a radial power circuit are drawn using the correct colour codes for cables and are labelled correctly with standard cable sizes and protective device which conform to accepted standards.

Evidence requirements

The candidate could be given a written exercise to test his/her knowledge by producing wiring arrangements for each circuit. The candidate must also be able to show an understanding of the circuits' applications and relevant British Standards.

Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

National Unit Specification: support notes

UNIT Basic Electrical Installation Systems and Protection (Intermediate 2)

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

It is recommended that you refer to the SQA Arrangements document for the Intermediate 2 Electrical Installation Fundamentals course before delivering this unit.

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

This unit will establish a foundation of electrical installation systems and circuits. It is written for electrical craft candidates but could also be used for craft candidates from other technology related backgrounds.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Outcome 1

Methods of generation.
Generation, transmission and distribution voltages.
The correct sequencing of the equipment at a consumer's intake position (supply and neutral link, kWh meter, isolation switch, consumer unit; what each piece of equipment provides.
The purpose of earthing.

Outcome 2

Forms of protection against over-current and shock used in a domestic consumer unit (semi-enclosed fuse, cartridge fuse, m.c.b and r.c.d).
The construction, operation, typical current ratings of protection devices.
The concept of earthing.

Outcome 3

The production of wiring arrangements for 1 way and 2 way lighting systems using singles and multi-core cables in a loop-in and joint box wiring system.
Cable sizes; protective device ratings of circuits for lighting circuits.
The production of wiring arrangements for a basic power radial circuit; socket outlet circuit.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Film/Video and discussions should be used on the methods of generation and how the electricity is transmitted to customers.

Physical examples of the intake position and discussion should be used to generate information on the customer's equipment at these positions.

Discussions, physical examples of and videos should be used to introduce the types of protective devices used and their advantages and disadvantages.

Discussions and practical workshop exercises reinforce the wiring of lighting circuits.

Discussions and practical workshop exercises to reinforce the wiring of the radial circuits.

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Systems and Protection (Intermediate 2)

Knowledge and Understanding	*Contexts, applications, illustrations and activities*
1 Know various methods of generating electrical energy	Videos and technical literature to show the different types of fuels used to generate electricity
2 Know typical generating and transmission voltage values	Draw diagrams to show typical transmission systems with voltages indicated
3 Know the sequence of control equipment at the consumer's intake position	Draw diagrams to show the sequence of the equipment at a consumer's intake point
4 Know the function of the consumer's control equipment	Describe the function of each item of control equipment
5 Know the purpose of earthing within an electrical installation	Describe earthing arrangements
6 Know the dangers of electricity and risks of electric shock	Examples of how a person can become part of a live electric circuit and the effects of increasing values of electric shock current. Videos to show the dangers of electric shock
7 Know the devices used for the protection against over-current and shock	Manufacturer's information sheets BS 7671
8 Draw circuit diagrams for 1-way and 2-way controlled lighting circuits	Diagrams using both loop-in and join box methods
9 Draw circuit diagrams for radial power circuits	Diagrams of socket, immersion heater, cooker and shower circuits
10 Determine standard cable and protective device ratings for given loads	Use manufacturer's literature, etc
11 Convert circuit diagrams, for power and lighting circuits to wiring diagrams	Draw diagrams of lighting and power circuits to convert one diagram form to the other

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Examples of instruments of assessment that could be used for each outcome are given below.
A graphical/written, objective/short answer exercise to assess the understanding of the generation of ac waveforms, its r.m.s. and peak values and the calculation of waveform frequency.
This exercise may also be used to assess the candidate's knowledge of the National Grid System and the order and voltages of the stages from generation to the consumer's input terminals.
The exercise will also assess the candidate's ability to identify the order of a consumer's intake position equipment and to explain the function of each piece of equipment shown in a given diagram.

Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

Outcome 2

An objective type exercise or a structured question to assess the candidate's comprehension of the types, causes and dangers associated with over-currents, the types of over-current and shock protection devices.
One of the questions will assess the candidate's recognition of a number of different types of protective devices. (The centre must supply the following devices for the candidate to physically handle: miniature circuit-breaker, cartridge fuse holder and residual current device.)

National Unit Specification: support notes (cont)

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Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

Outcome 3
A written exercise to assess the candidate's ability to produce wiring arrangements for lighting and radial power circuits and an understanding of circuit applications and relevant British Standards.

Satisfactory achievement of the outcome will be based on giving the correct responses to all of the exercise.

SPECIAL NEEDS
This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, publication code AA0645/3).