



Higher National Unit specification

General information

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Unit code: H6S4 33

Superclass: XJ

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Unit purpose

The Unit is aimed at learners working within the Electronic Fire and Security Systems Industry or those with an interest in gaining employment within this sector.

The Unit is designed to enable the learner to develop a general knowledge and understanding of the fundamentals of electrical engineering principles relevant in the installation of electronic fire and security systems.

This Unit forms part of the PDA in Providing Electronic Fire and Security Systems. This PDA provides underpinning knowledge and understanding for the SVQ level 3 in Providing Electronic Fire and Security Systems at SCQF level 6. The SVQ forms part of the Modern Apprenticeship in Electronic Security Systems.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Demonstrate an understanding of electrical engineering laws and formulae to determine the value of electrical quantities.
- 2 Explain the principles and formulae relating to the calculations of battery capacity required for standby times of electronic fire and security systems.
- 3 Demonstrate use of test equipment in relation to electronic fire and security systems.
- 4 Demonstrate an understanding of the electrical supply requirements of electrically powered devices.
- 5 Demonstrate an understanding of the principles of digital circuits.
- 6 Demonstrate processes for terminating wiring in different types of electronic fire and security systems.

Higher National Unit specification: General information (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Credit points and level

2 Higher National Unit credits at SCQF level 6: (16 SCQF credit points at SCQF level 6)

Recommended entry to the Unit

While entry is at the discretion of the centre, learners would normally be expected to have attained the following:

F3GF 11 *Numeracy (Core Skill Unit)*, SCQF level 5

or

C100 11 *Mathematics: Mathematics 1, 2 and 3 (Intermediate 2)*, SCQF level 5

or

C101 11 *Mathematics: Mathematics 1, 2 and Applications (Intermediate 2)*, SCQF level 5

or

2500 *Standard Grade Maths (Credit)*, SCQF level 5

together with

F3GB 11 *Communication (Core Skills Unit)*, SCQF level 5

or

C270 11 *English (Intermediate 2)*, SCQF level 5

or

0860 *Standard Grade English (Credit)*

A science or technical subject at SCQF level 5 would also be useful.

In the absence of formal qualifications, the centre may wish to interview or test the learner on general aptitude to make a judgement on whether the learner has the potential to achieve this Unit.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Higher National Unit specification: General information (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

Higher National Unit specification: Statement of standards

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

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 SQA.

Outcome 1

Demonstrate an understanding of electrical engineering laws and formulae to determine the value of electrical quantities.

Knowledge and/or Skills

- ◆ Descriptions of current, voltage, resistance, power and energy and their units of measurement
- ◆ Using formulae to calculate voltage, resistance, current, power and energy in electrical circuits, including Ohm's law, power and energy formulae
- ◆ Using formulae to calculate resistance in series and parallel circuits
- ◆ Resistor colour codes as used in the electronics industry

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ describe accurately current, voltage, resistance, power and energy and their units of measurement.
- ◆ use correctly the formulae to calculate voltage, resistance, current, power and energy in electrical circuits, including Ohm's law, power and energy formulae.
- ◆ use correctly the formulae to calculate unknown values for resistance in series and parallel circuits.
- ◆ describe accurately the resistor colour codes used in the electronics industry.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

The summative assessment tasks for Outcome 1 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately one hour 30 minutes should be allocated to the summative assessment of Outcome 1.

Outcome 2

Explain the principles and formulae relating to the calculations of battery capacity required for standby times of electronic fire and security systems.

Knowledge and/or Skills

- ◆ The types and sizes of batteries used in electronic fire and security systems
- ◆ Units and formulae relating to the calculation of standby battery capacity in line with the relevant standards
- ◆ Method of determining the quiescent and active current demand of electronic fire and security systems
- ◆ Standards for monitoring battery fail in electronic fire and security systems

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ explain correctly the types and sizes of batteries used in electronic fire and security systems.
- ◆ use correctly formulae to calculate standby battery capacity for electronic fire and security systems using appropriate unit notation.
- ◆ explain correctly the methods of determining the quiescent and active current demand of electronic fire and security systems.
- ◆ explain correctly the standards for monitoring batteries in electronic fire and security systems.

The summative assessment tasks for Outcome 2 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately one hour should be allocated to the summative assessment of Outcome 2.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Outcome 3

Demonstrate use of test equipment in relation to electronic fire and security systems.

Knowledge and/or Skills

- ◆ Digital multi meter
- ◆ Insulation resistance meter
- ◆ Digital sound and light meter
- ◆ Cathode ray oscilloscope and video test equipment
- ◆ Test probes/test lamps

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ use and record correctly the results obtained from a digital multi meter, including producing test results in appropriate formats for voltage, current, resistance and continuity.
- ◆ use and record correctly the results obtained from an insulation resistance test meter, including producing test results in appropriate formats for appliances and cabling systems.
- ◆ use and record correctly the results obtained from a digital sound and light test meter including producing test results in appropriate formats for the decibel levels from one piece of equipment.
- ◆ use and record correctly the results obtained from a cathode ray oscilloscope and video test equipment for one piece of equipment.
- ◆ use correctly test probes/test lamps for one piece of equipment to identify the presence of voltage in electronic fire and security systems.

The summative assessment tasks for Outcome 3 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately two hours should be allocated to the summative assessment of Outcome 3.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Outcome 4

Demonstrate an understanding of the electrical supply requirements of electrically powered devices.

Knowledge and/or Skills

- ◆ The current industry standards relating to system power supplies
- ◆ The power requirements of typical equipment used in the electronic fire and security industry
- ◆ The conversion of main supply voltage to low voltage: including the use of a power supply/transformer/rectifier
- ◆ Formulae used to calculate voltage drop

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ explain correctly the requirements of the current industry standards in relation to system power supplies.
- ◆ explain correctly the power requirements of typical equipment used in the electronic fire and security industry: including detectors, cameras, power supplies, control equipment, warning devices, locking mechanisms.
- ◆ explain correctly the conversion of main supply voltage to low voltage in a power supply unit.
- ◆ explain correctly why voltage drop occurs in electrical systems and use formulae to calculate voltage drop in electronic fire and security systems.

The summative assessment tasks for Outcome 4 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately one hour and 30 minutes should be allocated to the summative assessment of Outcome 4.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Outcome 5

Demonstrate an understanding of the principles of digital circuits.

Knowledge and/or Skills

- ◆ The format of binary systems
- ◆ Conversion of decimal numbers to binary format
- ◆ Calculations using the binary system
- ◆ Binary technology in electronic fire and security systems
- ◆ Logic gate and truth tables

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ explain correctly the format used in binary systems.
- ◆ convert correctly decimal numbers into binary format.
- ◆ use correctly the formulae to calculate binary numbers.
- ◆ explain correctly why and where binary is used in electronic fire and security systems.
- ◆ explain correctly logic gates and truth tables in digital circuits.

The summative assessment tasks for Outcome 5 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately one hour should be allocated to the summative assessment of Outcome 5.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Outcome 6

Demonstrate processes for terminating wiring in different types of electronic fire and security systems.

Knowledge and/or Skills

- ◆ Single pole, double pole and FSL wiring configurations
- ◆ Process used for terminating wiring for intruder alarm systems: global tamper configuration, series and parallel
- ◆ Process used for terminating wiring for fire alarm systems
- ◆ Process used for terminating and crimping wiring for CCTV systems: covering both digital and analogue systems
- ◆ Process used for terminating wiring for access control systems

Evidence Requirements

The learner should provide oral and/or written evidence to satisfy the Evidence Requirements.

There is no sampling in this Outcome. All aspects of Knowledge and Skills must be assessed.

The standard and quality of the evidence produced by the learner should be reflective of SCQF level 6 and demonstrate a detailed knowledge and understanding of all items in the Knowledge and Skills Section.

For this Outcome, each learner will:

- ◆ describe correctly the following wiring configurations used in the installation of intruder alarms: single pole, double pole and FSL (fully supervised loop) wiring configurations.
- ◆ demonstrate correctly the process for terminating wiring for intruder alarm systems.
- ◆ demonstrate correctly the process used for terminating wiring for fire alarm systems.
- ◆ demonstrate correctly the process used for terminating and crimping wiring for CCTV systems, covering both digital and analogue systems.
- ◆ demonstrate correctly the process used for terminating wiring for access control systems.

The summative assessment tasks for Outcome 6 will be undertaken in closed-book, timed and supervised conditions. All summative tasks must be unseen. Learners are not allowed to use reference sources. Approximately one hour should be allocated to the summative assessment of Outcome 6.

Higher National Unit specification: Statement of standards (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

For all Outcomes

Centres should devise Instruments of Assessment that will allow the learner to meet the Evidence Requirements for the Outcome to the required standard (See *Guide to Assessment*). It is recommended that centre devised Instruments of Assessment are prior verified by SQA.

Assessment for this Unit can be carried out at the discretion of the centre in the following ways:

- ◆ Outcome by Outcome
- ◆ Combining Outcomes
- ◆ One holistic assessment of the Unit

Suggestions for approaches to assessment can be found in the Support Notes of this Unit.

As this is an 80 hour Unit, approximately 8 hours should be dedicated to summative assessment for the entire Unit.



Higher National Unit Support Notes

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

This Unit forms part of the PDA Providing Electronic Fire and Security Systems. This PDA provides underpinning knowledge and understanding for the SVQ level 3 in Providing Electronic Fire and Security Systems at SCQF level 6. This SVQ forms part of the Modern Apprenticeship in Electronic Security Systems.

Although not directly awarded, completion of the Modern Apprenticeship Award gives opportunities to apply for professional recognition through the Institute of Engineering Technology and successful recognition will result in the EngTech qualification being awarded.

It may be possible to progress from the Modern Apprenticeship Award to other qualifications.

Centres should ensure that learners are presented with sufficient theoretical information to succeed in the assessment of this Unit.

Outcome 1

This Outcome covers the necessary underpinning knowledge and skills relating to electrical engineering and the use of laws and formulae to determine electrical quantities.

This Outcome is designed to give learners an understanding of the units of measurement for current, voltage, resistance, power, energy. In this Outcome learners should be taught Ohm's law and power and energy formulae to work out the unknown quantities in electrical circuits. For example, learners will need to know:

$$R=V/I$$
$$P=I^2 \times R$$
$$W=PX T$$

These formulae should then be used in other Outcomes throughout the programme, therefore retention of knowledge is vital.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

The learner must understand and calculate the resistance in the following circuits: series, parallel and series-parallel circuits.

For example, ($R_t = R_1 + R_2 + \dots$) AND ($1/R_t = 1/R_1 + 1/R_2 + \dots$).

Finally, learners should understand resistor colour codes as used in the electronic industry.

Outcome 2

This Outcome covers the necessary underpinning knowledge and skills relating to the principles and formulae required to calculate battery capacity.

Learners should be aware of the different types and sizes of batteries used in the security sector and their use.

Type

Lead Acid — Used as standby batteries in control equipment to maintain the system as operational in the event of power fail.

Lithium ion — Used in wireless alarm systems because of their high charge density (long life).

Sizes

2.1 amp — Used in small to medium intruder alarm installations

2.8 amp — Used in small to medium intruder alarm installations

7 amp — Used in medium to large intruder alarm installations and small — large fire alarm installations

17 amp — Used in large intruder alarm installations and small — large fire alarm installations

Learners will use the formula below to calculate the battery drain period for intruder, fire and access control systems. Learners need to take into account the quiescent and active demands on batteries to accurately calculate stand by times. The following should be covered:

C (capacity of battery in Ah) = A (current drain in Amps) x t (time of discharge in hours).

Learners will be able to explain the new standards relating to the monitoring of batteries that are installed in the security industry. The BS EN 50131 standard highlights that each battery installed in the security industry should be individually monitored for 'battery fail'.

An APS fault signal shall be generated within 10 seconds if a low battery condition is detected or a storage device failure is detected.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Comfort (Type A — Power supply) detects no battery connected within 10 seconds and gives a battery alarm which has the same behaviour as a low battery alarm. This will prevent setting of the alarm system, unless the setting for allow low battery arm is enabled.

Outcome 3

This Outcome covers the correct use of test equipment when installing, commissioning or maintaining electronic fire and security systems.

This Outcome is designed to give learners a better understanding of the processes to follow when testing the operational requirements of electronic fire and security systems and the correct method for recording this data.

The learner must have a basic theoretical understanding of the tests that should be carried out at each stage of the life of an electronic fire and security system and the specific results obtained. This knowledge will help build a basis for carrying the tests out practically. The following test equipment should be used:

- ◆ Multi meter: testing for extra low voltage, current, resistance and continuity
- ◆ Insulation/resistance meter: testing the insulation resistance for appliances and cabling systems
- ◆ Digital sound and light meter: testing for the LUX levels in a normal room, hallway and outside; testing the decibel levels from an external sounder, keypad and internal speaker
- ◆ Cathode ray oscilloscope and video test equipment, including a Cat 5 twisted pair test meter and video test monitor; testing for constantly varying signal voltages, open circuit, short circuit, jumper wire, reverse connection or cross-talk interference
- ◆ Test probes/test lamps to confirm the presence of voltage in electronic fire and security systems

Outcome 4

This Outcome is designed to give learners a better understanding of the electrical supply requirements of electrically powered devices currently used within electronic fire and security systems.

In particular, learners should gain knowledge of the power requirements of the devices and equipment used in electronic fire and security systems and the standards pertaining to system power supplies.

Learners should have a basic understanding of the process of conversion of mains supply voltage to low voltage and rectification circuits. In particular, that the use of a power supply/transformer is to reduce, convert, regulate and protect.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Learners will understand the following standards pertaining to power supply requirements:

- ◆ BS EN 50131:6 — Intrusion systems power supplies

There are three types of power supply defined, each having different requirements to adhere to EN50131. The type of power supply is classified based on its characteristics and its requirements are defined in terms of their standby duration.

The three classes are:

- ◆ **Type A**, which contains mains and rechargeable backup batteries
 - ◆ **Type B**, which contains mains and non-rechargeable backup batteries
 - ◆ **Type C**, which contains batteries alone.
-
- ◆ EN54-4:1997/A2:2006 — Fire alarm systems power supplies

Fire legislation in most European countries states any power supply performing a mandatory function of a fire alarm system must comply with EN54-4/A2. As such, any power supply controlling a beam detector, auto-dial communicator, aspirating smoke detector, auto-open ventilation system or auxiliary sounder system must comply with this standard.

Equipment:

- ◆ Detectors
- ◆ Power supplies
- ◆ Cameras
- ◆ Control Equipment
- ◆ Warning devices
- ◆ Locking mechanisms

Learners should have a basic understanding of the process of conversion of mains supply voltage to low voltage and rectification circuits. In particular, that the job of a power supply/transformer is to reduce, convert, regulate and protect.

Each piece of equipment has a minimum requirement that it can operate at, according to the IEE wiring regulations (BS 7671). If the voltage drop from power source to equipment is more than 4%, then this is non-compliant with the standards. As it is a requirement of the IEE wiring regulations, learners must gain the skills to calculate the voltage drop of cable runs to ensure the voltage drop of the cable run is not more than 4%. This can be done by using the following formulae:

- ◆ Volt drop AC ($I \times D \times V/A/M$)
- ◆ Volt drop DC ($2I \times R$)

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Outcome 5

This Outcome covers the principles of digital circuits. The learners should have an understanding of the binary system, logic gates and truth tables used in the electronic fire and security systems.

Through completion of this Outcome learners will understand why the binary system is relevant to electronic fire and security systems and where, in particular, it will be used. For example, when addressing IP or PTZ Cameras.

Learners must be able to convert decimal numbers (addresses) into binary format in order to correctly address cameras or fire detection devices. Learners should also be shown how to add two or three binary addresses together.

Have an understanding of logic gate: NOT; AND; OR; NAND; NOR; exclusive OR; multiple integrated circuit gates and where logic gates are used in electronic fire and security systems.

Outcome 6

This Outcome covers system circuitry used in the installation of electronic fire and security systems. Learners will improve their understanding of the processes used to terminate wiring correctly through practical activities. This must include mechanical properties.

The following are examples of what should be covered in this Outcome for each discipline:

Intruder Alarms

- ◆ Single pole wiring
- ◆ Double pole wiring
- ◆ FSL Configuration
- ◆ Global tamper
- ◆ Series
- ◆ Parallel
- ◆ 5 mm conductor
- ◆ 150 mm of wire once entered the control equipment

Fire Alarms

- ◆ Parallel wiring
- ◆ Ring circuits
- ◆ Radial circuits
- ◆ Independent sounder circuits
- ◆ Addressable wiring
- ◆ Conventional wiring
- ◆ EOL monitoring

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

CCTV

- ◆ Analogue wiring
- ◆ Digital wiring
- ◆ Stripping and preparing cables
- ◆ Installing BNC
- ◆ Installing RJ45
- ◆ Telemetry
- ◆ Series

Access Control

- ◆ Cable selection
- ◆ Ring circuits for networking of systems
- ◆ Switch wires to control locks
- ◆ Connecting relays and fire interfaces
- ◆ Stripping and preparing cables

Guidance on approaches to delivery of this Unit

This Unit can be delivered as a free-standing Unit or as part of a Group Award. This Unit is mandatory in the PDA Providing Electronic Fire and Security Systems and is designed to give learners the underpinning knowledge and skills to support the SVQ level 3 in Providing Electronic Fire and Security Systems. The SVQ forms part of the Modern Apprenticeship in Electronic Security Systems.

A variety of delivery approaches could be adopted in this Unit and, although there is no preferred order of teaching, a systematic approach is recommended. Practitioners should use their professional judgement in designing and delivering the Unit so that it is appropriate, relevant and motivating for individual learners. Approaches should be learner-centred, participative and practical. For example, group activities, one-to-one tutorials, differentiated learning materials and visual aids. Home study activities should also be designed.

Links in this Unit should be made to the National Occupational Standards (NOS) for electronic security systems and in particular:

SYS 10	Install electronic fire and security systems
SYS 11	Test and confirm operations of electronic fire and security systems

Learners could use information or resources acquired during this Unit to help with the completion of the above NOS.

It is recommended that use of a wiki or similar should be encouraged to allow learners to share knowledge and research findings.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Where resources permit, centres should use technology as much as possible to support learning, teaching and assessment. This could include, for example:

- ◆ Compiling and maintaining e-portfolios
- ◆ Web-based research
- ◆ Game based learning
- ◆ Using chat rooms for discussion
- ◆ Using virtual learning environments
- ◆ Submission of assessed work through VLE, e-mail

The learning and teaching approaches used should encourage learners to be aware of the Knowledge and/or Skills gained, to retain these and use in other contexts.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Centres should create formative assessments that are both appropriate to the individual's needs and which also prepare the learner for summative assessment. Summative assessment should only take place when the learner has developed the Knowledge and Skills at the required level for the Unit.

Lecturers should provide adequate opportunities for informal assessment to take place prior to learners undertaking summative assessments. Lecturers may give learners advice and support during any informal assessment in order to prepare them for summative assessment.

Centres may use Instruments of Assessment which are considered by lecturers to be most appropriate. Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that could be transferable to work or further and higher education.

A range of different assessment methods could be used. Suggested examples can be found in SQA's Guide to Assessment. www.sqa.org.uk

Records of all assessment instruments used and evidence produced by each learner for summative assessment purposes — oral/written/practical — must be retained for internal and external verification purposes.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Practical evidence can be either:

- ◆ Assessor Checklist with oral questioning

or

- ◆ Photographic/video evidence

All learner evidence must be signed and dated by the assessor thus ensuring authentication.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

There are opportunities to develop aspects of Core Skills in *Communication* (Oral and Written Communication), *Numeracy* (Using Number), *Problem Solving* (Critical Thinking and Planning and Organising) and *Working with Others* (Working Co-operatively with Others).

Communication: Oral Communication

The Core Skill component Oral Communication at SCQF level 6 could be developed in this Unit. The general skill for this component is — *Produce and respond to oral communication on a complex topic*. Learners could fulfil this component through participating in discussions, one-to-one dialogues and group work for both formative and summative assessment purposes. Tasks involving group activities and joint feedback sessions will offer the learner opportunities to make a contribution to a discussion on a complex topic.

Communication: Written Communication

The Core Skill component Written Communication (Writing) at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Produce well-structured written communication*. Learners could fulfil this component through research activities and the production of reports, essays or other forms of written communication. Some learners may develop this skill at SCQF level 6.

Higher National Unit Support Notes (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Numeracy: Using Number

The Core Skill component Using Number at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Apply a range of numerical skills in various everyday situations*. The component could be developed by using complex formulae in Outcomes 1, 2, 4 and 5. For example, Ohm's law, energy, power formulae, calculating battery capacity, voltage drop and binary.

Problem Solving: Critical Thinking

The Core Skill component Critical Thinking at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Analyse a situation or issue*. This component could be developed where a situation or issue has arisen in the course of the learner's work or study. The learner would need to analyse and evaluate the situation or issue and devise a strategy to deal with it. The learner should reflect on and evaluate the success of the strategy. Alternatively, the tutor could provide a case study.

Problem Solving: Planning and Organising

The Core Skill component Planning and Organising at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Plan, organise and complete a task*. This component could be developed through planning, organising and completing a task. The learner would need to develop a plan, identify and obtain the required resources and then carry out the task. Resources could include, for example, time available, paper work and documentation, set procedures, people and equipment. The learner must decide on how the task will be managed. This could include allocation of responsibilities in a group context. Planning and organising skills could be developed through the completion of home study, research and practical tasks.

Working with Others: Working Co-operatively with Others

The Core Skill component Working Co-operatively with Others at SCQF level 6 could be developed in this Unit. The general skill for this component is — *In complex interactions, work with others co-operatively on an activity and/or activities*. This component could be developed by gathering evidence from the workplace or by taking part in group activities in the centre. This could include, for example, joint information and feedback sessions, group research or practical activities. In Outcome 6, learners could work in groups to identify the correct methods to use when terminating devices.

Other Essential Skills developed through the completion of this Unit

- ◆ Time Management: through the completion of projects and research task the learner will learn new skills in how to manage their own time to help achieve a common goal.

History of changes to Unit

Version	Description of change	Date

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Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Business Development and Customer Support team, telephone 0303 333 0330.

General information for learners

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Unit is aimed at those working within the Electronic Fire and Security Systems Industry or with an interest in gaining employment within this sector.

The Unit is designed to enable you to develop a general knowledge and understanding of the fundamentals of electrical engineering principles relevant in the installation of electronic fire and security systems.

This Unit forms part of the PDA in Providing Electronic Fire and Security Systems. This PDA provides underpinning knowledge and skills for the SVQ level 3 in Providing Electronic Fire and Security Systems at SCQF level 6. The SVQ forms part of the Modern Apprenticeship in Electronic Security Systems.

On completion of the Unit you will be able to:

- 1 Demonstrate an understanding of electrical engineering laws and formulae to determine the value of electrical quantities.
- 2 Explain the principles and formulae relating to the calculations of battery capacity required for standby times of electronic fire and security systems.
- 3 Demonstrate use of test equipment in relation to electronic fire and security systems.
- 4 Demonstrate an understanding of the electrical supply requirements of electrically powered devices.
- 5 Demonstrate an understanding of the principles of digital circuits.
- 6 Demonstrate processes for terminating wiring in different types of electronic fire and security systems.

You will participate in class lectures, group activities and home study.

There are different ways in which you can be assessed. Questions will be generated to test your knowledge and understanding. Practical exercises will be used to assess your skills.

There is no automatic certification of Core Skills in this Unit. However, there are opportunities to develop aspects of Core Skills in *Communication* (Oral and Written Communication), *Numeracy* (Using Number), *Problem Solving* (Critical Thinking and Planning and Organising) and *Working with Others* (Working Co-operatively with Others).

Communication: Oral Communication

The Core Skill component Oral Communication at SCQF level 6 could be developed in this Unit. The general skill for this component is — *Produce and respond to oral communication on a complex topic*. You could fulfil this component through participating in discussions, one-to-one dialogues and group work for both formative and summative assessment purposes. Tasks involving group activities and joint feedback sessions will offer you opportunities to make a contribution to a discussion on a complex topic.

General information for learners (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Communication: Written Communication

The Core Skill component Written Communication (Writing) at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Produce well-structured written communication*. You could fulfil this component through research activities and the production of reports, essays or other forms of written communication. You may develop this skill at SCQF level 6.

Numeracy: Using Number

The Core Skill component Using Number at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Apply a range of numerical skills in various everyday situations*. You could fulfil this component by using complex formulae in Outcomes 1, 2, 4 and 5. For example, Ohm's law, energy, power formulae, calculating battery capacity, voltage drop and binary.

Problem Solving: Critical Thinking

The Core Skill component Critical Thinking at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Analyse a situation or issue*. This component could be developed where a situation or issue has arisen in the course of your work or study. You would need to analyse and evaluate the situation or issue and devise a strategy to deal with it. You should reflect on and evaluate the success of the strategy. Alternatively, your tutor could provide a case study.

Problem Solving: Planning and Organising

The Core Skill component Planning and Organising at SCQF level 5 could be developed in this Unit. The general skill for this component is — *Plan, organise and complete a task*. This component could be developed through planning, organising and completing a task. You would need to develop a plan, identify and obtain the required resources and then carry out the task. Resources could include, for example, time available, paper work and documentation, set procedures, people and equipment. You must decide on how the task will be managed. This could include allocation of responsibilities in a group context. Planning and organising skills could be developed through the completion of home study, research and practical tasks.

Working with Others: Working Co-operatively with Others

The Core Skill component Working Co-operatively with Others at SCQF level 6 could be developed in this Unit. The general skill for this component is — *In complex interactions, work with others co-operatively on an activity and/or activities*. This component could be developed by gathering evidence from the workplace or by taking part in group activities in the centre. This could include, for example, joint information and feedback sessions, group research or practical activities. In Outcome 6 you could work in a group to identify the correct methods to use when terminating devices.

General information for learners (cont)

Unit title: Electronic Fire and Security Systems: Electrical Engineering Principles (SCQF level 6)

Other Essential Skills developed through the completion of this Unit

- ◆ Time Management: through the completion of projects and research task you will learn new skills in how to manage your own time to help achieve a common goal.

Although not directly awarded, completion of the Modern Apprenticeship Award gives opportunities to apply for professional recognition through the Institute of Engineering Technology and successful recognition will result in the EngTech qualification being awarded.