

SQA Advanced Unit Specification

General information for centres

Unit title: Electrical Installation Design (Computer Aided): An Introduction

Unit code: HV2X 47

Unit purpose: This Unit has been designed to allow candidates to develop the skills required to obtain and input data into commercial software to design Electrical Installation circuits to comply with the current wiring regulations, BS 7671. This Unit has also been designed to develop the necessary knowledge and understanding to produce an electrical installation design as a complete, fully detailed, personalised design and schematic drawing.

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

- 1 Develop electrical schematic diagrams.
- 2 Perform electrical installation design calculations using computer software.
- 3 Produce electrical installation design reports.

Credit points and level: 1 SQA 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 National 1 to Doctorates.*

Recommended prior knowledge and skills: Entry is at the discretion of the centre. However, candidates should have a broad knowledge and understanding of the design of electrical power distribution systems, the installation of electrical wiring systems, accessories and cabling and the inspection and testing of electrical installations. This may be evidenced by the possession of the following SQA Advanced Units:

- ◆ Application of Electrical and Electronic Instruments (HV2H 46)
- ◆ Inspection and Testing of Low Voltage Electrical Installations (HV2L 47)

Core Skills: There are opportunities to develop the Core Skills of Using Graphical Information and Critical Thinking at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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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.

Assessment: The assessment for the three Outcomes should be integrated into two complete installation design assignments. For both assignments candidates must produce all of the Knowledge and Skills for all of the Outcomes in the Unit.

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SQA Advanced Unit Specification: statement of standards

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

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

Develop electrical schematic diagrams

Knowledge and/or skills

- ◆ Schematic diagram
- ◆ Diagram symbols
- ◆ Diagram drafting
- ◆ Diagram labelling

Evidence Requirements

All knowledge and/or skills items in the Outcome should be assessed.

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

- ◆ produce a satisfactory schematic diagram for the assignments
- ◆ use acceptable diagram symbols complying with current requirements
- ◆ use acceptable diagram drafting complying with current requirements
- ◆ use acceptable labelling in the diagrams

In addition to the two assignment progress reports an assessment checklist is required.

Assessment guidelines

The assessment for Outcome 1 of this Unit should be present within the contents of the assignments. Details of the assignments are given in the Assessment guidelines section of Outcome 3.

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Outcome 2

Perform electrical installation design calculations using computer software

Knowledge and/or skills

- ◆ Inputting design data
- ◆ Load selection
- ◆ Distribution board selection
- ◆ Cable type and installation method selection
- ◆ Protective device selection
- ◆ Perform design calculations
- ◆ Identify, investigate and rectify faults

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

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

- ◆ input the design data
- ◆ define the load types
- ◆ select distribution boards in terms of number of ways and number of phases
- ◆ select cables and their installation methods and correctly connect these to their terminations
- ◆ select protective devices
- ◆ perform the installation design calculations
- ◆ identify, investigate and rectify faults to produce a satisfactory design

In addition to the two assignment progress reports an assessment checklist is required.

Assessment guidelines

The assessment for Outcome 2 of this Unit should be present within the contents of the assignments. Details of the assignments are given in the Assessment guidelines section of Outcome 3.

Outcome 3

Produce electrical installation design reports

Knowledge and/or skills

- ◆ Report identification
- ◆ Input and design parameters
- ◆ Cable schedules
- ◆ Circuit design data
- ◆ Fault report

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

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

- ◆ personalise each page of their report
- ◆ produce sections of report showing the input data and resultant design parameters
- ◆ produce a cable schedule
- ◆ produce design data
- ◆ produce a fault report which proves that a satisfactory design has been achieved

In addition to the two assignment progress reports an assessment checklist is required.

Assessment guidelines

The assessment for Outcome 3 of this Unit should be present within the contents of the assignments. It is thus part of the overall 20 hours of assignment work.

The assessment for all three Outcomes should be integrated into two complete installation design assignments.

The first assignment should comprise of inputting supplied input data for a complete electrical installation into commercial software. The data will include:

- ◆ supply characteristics
- ◆ a description of cable termination locations
- ◆ the cable type
- ◆ reference method of installation
- ◆ length
- ◆ maximum temperature
- ◆ protective device
- ◆ three/single phase
- ◆ load current
- ◆ power factor
- ◆ motor characteristics (load current, power factor, efficiency, starting method)
- ◆ circuit types (ring and radial)
- ◆ load descriptions
- ◆ main distribution board supplying at least five other distribution boards

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This assignment should involve approximately eight hours of work.

The second assignment will be based on a given scale drawing of an installation. This drawing will involve a description of the building construction including heights and show the locations of all accessories, loads and cable routing. From this the candidate should estimate cable lengths (adding a suitable correction amount of 10%) and identify circuits to which correction factors apply. At least one circuit must have grouping correction, one circuit temperature correction and one circuit both grouping and temperature correction. Additional data will include:

- ◆ supply characteristics
- ◆ a description of cable termination locations
- ◆ the cable type
- ◆ reference method of installation
- ◆ maximum temperature
- ◆ protective device
- ◆ three/single phase
- ◆ load current
- ◆ power factor
- ◆ motor characteristics (load current, power factor, efficiency, starting method)
- ◆ circuit types (ring and radial)
- ◆ load descriptions
- ◆ main distribution board supplying at least five other distribution boards

This assignment should involve approximately 12 hours of work.

Both assignments should be conducted under controlled, supervised conditions, and should constitute 20 hours of work in total, including re-assessment if necessary. Candidates may have access to copies of the current wiring regulations, BS 7671 and an equipment manufacturers' catalogue.

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Administrative Information

Unit code: HV2X 47

Unit title: Electrical Installation Design (Computer Aided): An Introduction

Superclass category: XJ

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History of changes:

Version	Description of change	Date

Source: SQA

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SQA Advanced Unit Specification: support notes

Unit title: Electrical Installation Design (Computer Aided): An Introduction

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 using computer software in the following areas:

- 1 Developing electrical schematic diagrams.
- 2 Performing electrical design calculations.
- 3 Producing electrical installation design reports.

In designing this Unit, the Unit writer has identified the range of topics that he would expect to be covered by lecturers. It is recommended that lecturers spend 20 hours covering these topics before candidates start the two assignments. Whilst it is not mandatory for centres to use this list of topics, it is recommended that they do so.

A list of topics for each Outcome is given below. Lecturers are advised to study this list so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

1 Develop electrical schematic diagrams

- ◆ extract the logic of the electrical installations to be designed
- ◆ translate this 'logic' into an acceptable electrical schematic diagram
- ◆ incorporate acceptable symbols within the electrical schematic diagram
- ◆ drafting (the drawing should be incorporated in a suitable template giving, as a minimum, the candidate's name, class, Unit number, college session and drawing number)
- ◆ labelling

2 Perform electrical installation design calculations using computer software

From the scale of appropriate drawings (adding a suitable correction amount, 10% suggested) estimate cable lengths and enter this data:

- ◆ correctly select and enter the load types
- ◆ correctly select distribution boards in terms of number of ways and number of phases
- ◆ correctly select the cable types, their methods of installation and any further correction factors applicable and correctly connect these to their termination points
- ◆ correctly select the required protective devices
- ◆ carry out the design calculation
- ◆ identify, investigate and rectify faults to give an acceptable installation design

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3 Produce electrical installation design reports

Reports must be identified by, as a minimum, the candidate name and assignment identifier.

Produce an appropriate input and design parameter reports to include:

- ◆ cable schedules
- ◆ circuit design data
- ◆ fault report

All to an acceptable standard.

Practically based assignments: 20 hours.

Guidance on the delivery and assessment of this Unit

This Unit should be presented at all times with reference to the specific design software available.

The software employed is at the discretion of the centre but it must be specifically an electrical installation design package.

It is recommended that the candidates undertake the assignments after an initial 20-hour introduction to the software package in conjunction with the use of design tutorials.

In delivering this Unit candidates should be provided with the opportunity to gain as much ‘hands on’ experience as possible. Ideally each candidate should have a p.c. to work with but if, due to resource constraints, this is not possible, then, for non-assessment purposes candidates should work in small groups. If candidates work in small groups it is essential that each candidate makes a full contribution to electrical installation software developments. Candidates must undertake the assignments on an **individual** basis.

Candidates will have opportunities to develop their Using Information Technology core skills while using the electrical installation design software to input data, perform calculations and output reports. Opportunities to develop critical thinking skills may take place while developing electrical installation designs.

Details on approaches to assessment are given under the Assessment guidelines in Outcome 3 in the SQA Advanced Unit specification: statement of standards section. It is recommended that this section be read carefully before proceeding with assessment of candidates.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Using Graphical Information and Critical Thinking at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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Open learning

Candidates who have access to suitable software (for example in their employment) could take this Unit by open and distance learning which may include on-line support. With regard to assessment however, planning would be required by the centre concerned to ensure the authenticity of candidate evidence. Arrangements would require to be put in place to ensure that assessment was conducted under controlled and supervised conditions.

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.

General information for candidates

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The widespread use of commercially available electrical installation design software in design offices means that skill in their use is now essential for designers. The advantages of such a design package are:

- ◆ It meets the requirements of the current wiring regulations, BS 7671, which also means that it meets the requirements of the Statutory Regulations referred to therein.
- ◆ The schematic diagram(s) and report(s) produced meet the requirements of the Electrical Contractors' Association (ECA) and National Inspection Council for Electrical Installation Contracting (NICEIC).
- ◆ The schematic diagram(s) and report(s) form the documentation are considered suitable for the inspection and testing of installations.

This Unit has been designed to develop your knowledge and understanding in the use of such software. You will develop the skills required to produce electrical installations as a complete, fully detailed, personalised design report and schematic drawing. Initial introduction to the software package in conjunction with design tutorial will take approximately 20 hours preparing you for the two assignments which are the formal assessment for this Unit.

The assignments will consist of 20 hours of work in total and will be conducted under controlled and supervised conditions. You will be allowed access to a copy of the current wiring regulations. BS 7671 and an equipment manufacturer's catalogue.

The first assignment will comprise input data for a complete installation. The candidate will then be required to translate this into a schematic diagram and input the data of the software design. You will then produce a satisfactory personalised report for your electrical installation design which will be acceptable within the electrical design/contracting industry.

The second assignment will comprise a design description including a given scale drawing of a building, showing:

- ◆ the location of all relevant accessories and loads
- ◆ cable routing
- ◆ containment methods
- ◆ types of cabling
- ◆ the arrangements of the live conductors
- ◆ type of earthing and
- ◆ the characteristics of the supply

The candidate will then be required to translate this into a schematic diagram and the input data of a software design. You will then produce a satisfactory personalised report for your electrical installation design which will be acceptable within the electrical design/contracting industry.

This assignment will normally be carried out at the end of the delivery of the Unit.