

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Electrical Installation Design: Computer Aided

**Unit code:** HV52 48

**Unit purpose:** Developing the skills required to design Electrical Installation circuits to comply with the current wiring regulations, BS 7671, using commercial computer software. This unit is designed to develop the necessary knowledge and understanding of translating the requirements of an electrical installation design into 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 8: (8 SCQF credit points at SCQF level 8\*)

*\*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:** 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: HP46 47 DC and AC Principles, HT7K 47 Three-phase Systems, HV3L 47 Electricity Power Systems, HV2H 46 Application of Electrical and Electronic Instruments, HV2L 47 Inspection and Testing of Low Voltage Electrical Installations, HV3A 47 Electrical Safety and HV5X 48 Electrical Installation Design. However, entry requirements are at the discretion of the centre.

**Core skills:** There may be opportunities to gather evidence towards the following listed core skills or core skills components in this unit, although there is no automatic certification of core skills or core skills components:

- ◆ Written Communication (reading) at SCQF level 6
- ◆ Written Communication (writing) at SCQF level 6
- ◆ Using Graphical Information at SCQF level 6
- ◆ Using Information Technology at SCQF level 6
- ◆ Critical Thinking at SCQF level 6
- ◆ Planning and Organising at SCQF level 6
- ◆ Working with Others at Intermediate 1

**Context for delivery:** This unit was developed for the SQA Advanced Diploma in Electrical Engineering. If this unit is delivered as part of another group award, it is recommended that it be taught and assessed within the subject area of the group award to which it contributes.

**Assessment:** The assessment for all the outcomes of this unit are to be integrated into a complete installation design assignment. The unit employs learning through discovery and the candidate goes on to complete a final assignment. The assignment will comprise of a detailed design specification. A given scale drawing of a building, the electrical installation of which is to be designed will be provided. The drawing will show the location of all relevant accessories and loads with a description of the building's ceiling/roof height, its construction and any external influences present, and the arrangements of the live conductors, type of earthing and the characteristics of the supply. Cable routing will not be shown.

The assignment must include:

- ◆ an unbalanced three-phase, five-wire supply of maximum demand 500-1000 amperes per phase
- ◆ at least three distribution boards other than the main distribution board with 1 distribution board having an unbalanced three-phase maximum demand of 200-300 amperes per phase
- ◆ single phase current using equipment
- ◆ three-phase current using equipment
- ◆ fixed appliances
- ◆ portable appliances (fed from socket outlets)
- ◆ lighting loads
- ◆ motor loads (using at least two different starting methods)
- ◆ at least three different cable types
- ◆ at least three different installation methods
- ◆ at least two circuits requiring ambient temperature correction
- ◆ at least two circuits requiring grouping correction
- ◆ at least one circuit requiring both ambient temperature and grouping correction

This assignment should be conducted under controlled, supervised conditions, and should constitute 30 hours work, including re-assessment if necessary following initial introduction to the software package in conjunction with design tutorials taking approximately 10 hours. Candidates may have access to copies of the current wiring regulations, BS 7671 and an equipment manufacturer's catalogue.

## **SQA Advanced Unit Specification: statement of standards**

**Unit title:** Electrical Installation Design: Computer Aided

**Unit code:** HV52 48

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**

- ◆ Production of schematic diagram
- ◆ Diagram symbols
- ◆ Diagram drafting
- ◆ Diagram labelling

#### **Evidence requirements**

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 assignment
- ◆ use acceptable diagram symbols complying with current requirements
- ◆ use acceptable diagram drafting complying with current requirements
- ◆ use acceptable labelling in the diagram

An assessment checklist in addition to four assignment progress reports is required.

#### **Assessment guidelines**

The assessment for Outcome 1 of this unit is present within the assignment. It is part of the overall 30 hours of work.

## Outcome 2

Perform electrical installation design calculations using computer software

### Knowledge and/or skills

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

### Evidence requirements

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

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

An assessment checklist in addition to four assignment progress reports is required.

### Assessment guidelines

The assessment for Outcome 2 of this unit is present within the assignment. It is part of the overall 30 hours of work.

## **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**

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

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

An assessment checklist in addition to four assignment progress reports is required.

### **Assessment guidelines**

The assessment for Outcome 3 of this unit is present within the assignment. It is part of the overall 30 hours of work.

## **Administrative information**

<b>Unit code:</b>	HV52 48
<b>Unit title:</b>	Electrical Installation Design: Computer Aided
<b>Superclass category:</b>	TH
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## Higher National Unit Specification: support notes

### Unit title: Electrical Installation Design: Computer Aided

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 employs learning through discovery and the candidate goes on to complete a final assignment. This unit has been written in order to allow candidates to develop knowledge, understanding and skills in using computer software in the following areas:

- ◆ develop electrical schematic diagrams
- ◆ perform electrical design calculations
- ◆ produce electrical installation design reports

This unit is SCQF level 8 and has been devised as an optional unit within the new SQA Advanced Diploma in Electrical Engineering. However, this does not preclude the use of this unit in other awards where award designers feel this to be appropriate.

In designing this unit, the unit writer has identified the range of topics expected to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the outcomes. While 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

From a given scale drawing of a building, the electrical installation of which is to be designed, showing the location of all relevant accessories and loads with a description of the building's ceiling/roof height and its construction.

The candidate will:

- ◆ extract the logic of electrical installation to be designed from the labelling given on the assignment information
- ◆ translate this 'logic' into an acceptable electrical schematic diagram
- ◆ ensure the electrical schematic diagram incorporates acceptable symbols
  - 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 the assignment drawing (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 calculations
- ◆ Identify, investigate and rectify faults to given an acceptable installation design

## **3 Produce electrical installation design reports**

- ◆ Reports must be identified by, as a minimum, the candidate's name and assignment identifier
- ◆ Production of appropriate input and design parameter reports to include:
  - cable schedules
  - circuit design data
  - fault report

All to an acceptable standard.

**Unit Assessment**      One practical assignment      30 hours

## **Guidance on the delivery and assessment of this unit**

It is intended that this unit is presented by at all times referring to the specific design software available.

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

In the delivery of this unit, candidates should be provided with the opportunity to gain as much 'hands on' experience as possible. Ideally each candidate should have a PC to work with but if, due to resource constraints, this is not possible, then, for non assessment purposes candidates could work in small groups. If candidates are working in small groups it is essential that each candidate participates. Candidates must undertake this assignment on an individual basis.

Details on approaches to assessment are given under evidence requirements and assessment guidelines under each outcome in the SQA Advanced Unit Specification; statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.



## **Open learning**

Candidates who have access to suitable software for example in their employment, could achieve this unit by open learning. With regard to assessment however, planning would be required of 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. This could involve the candidate attending the centre. Alternatively, special arrangements could be made for the candidate to demonstrate their work to a designated, responsible person, local to the candidate.

For information on normal open learning arrangements, please refer to the SQA guide Assessment and Quality Assurance of Open and Distance Learning (SQA 2000).

## **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](http://www.sqa.org.uk/assessmentarrangements).

## General information for candidates

### Unit title: Electrical Installation Design: Computer Aided

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 that:

- ◆ 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 Contracting Association (ECA) and National Inspection Council for Electrical Industry Contractors (NICEIC) bodies
- ◆ the schematic diagram(s) and report(s) form the documentation considered suitable for the inspection and testing of the installation

This unit has been designed to develop the necessary knowledge and understanding to use such software. You will develop the skill to translate the requirements of an electrical installation design into a complete, fully detailed, personalised design report and schematic drawing. Initial introduction to the software package in conjunction with design tutorials will take approximately 10 hours preparing you for the assignment which is the formal assessment for this unit.

The assignment will be 30 hours work 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.

This assignment will present you with a graphical and written description of the electrical installation to be designed. You will then be required to translate this into a schematic diagram and the input data of your 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.