National Unit Specification: general information

UNIT Installation of Conduit Systems (SCQF level 6)

CODE F5FY 12

SUMMARY

This Unit is intended for candidates with little or no prior knowledge of electrical conduit systems but who wish to gain an understanding of these systems and develop skills in their fabrication and installation.

The aim of this Unit is to develop candidate's knowledge and understanding of conduit systems and to develop also their fabrication and assembly skills. The Unit will develop the candidate's understanding of the techniques of conduit installation in relation to the requirements of the Wiring Regulations BS7671.

It will also give candidates an understanding of circuit and wiring diagrams and develop their ability to wire circuits using single-core PVC cables. Candidates will also be introduced to circuit testing and be provided with opportunities to carry out basic circuit inspection and testing procedures.

This Unit may form part of a National Qualification Group Award or may be offered on a free-standing basis.

OUTCOMES

1 Interpret the requirements for conduit systems and single-core PVC wiring in terms of the Wiring Regulations BS7671 and state the advantages and limitations of conduit systems.
2 Demonstrate the skills and techniques used in the fabrication, assembly and installation of conduit systems.
3 Interpret wiring requirements from circuit diagrams.
4 Demonstrate the skills and techniques used when installing, inspecting and testing circuit wiring enclosed in conduit systems.

Administrative Information

Superclass: XJ

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National Unit Specification: general information (cont)

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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 Mathematics — Credit Level
- Standard Grade Technological Studies — Credit Level
- Standard Grade Physics — Credit Level
- NQ Unit *Installation of Conduit Systems* at SCQF level 5
- NQ Unit *Inspection and Testing of Electrical Installations* at SCQF level 5

CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6*).

**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.*

CORE SKILLS

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

This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- Problem Solving (SCQF level 6)
- Numeracy (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Installation of Conduit Systems (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

Interpret the requirements for conduit systems and single-core PVC wiring in terms of the Wiring Regulations BS7671 and state the advantages and limitations of conduit systems.

Performance Criteria

(a) Identify and interpret correctly the BS7671 requirements for conduit and conduit systems.
(b) Identify and interpret correctly the BS7671 requirements for single-core PVC wiring enclosed in conduit.
(c) State correctly the advantages and limitations of non-metallic and steel conduit systems.

OUTCOME 2

Demonstrate the skills and techniques used in the fabrication, assembly and installation of conduit systems.

Performance Criteria

(a) Identify correctly types of steel and non-metallic conduit and their accessories.
(b) Measure, cut, bend, set and thread (steel only) both non-metallic and steel conduit to given dimensions.
(c) Demonstrate the assembly and installation of conduit systems using non-metallic and steel conduit to given specification requirements and dimensions.

OUTCOME 3

Interpret wiring requirements from circuit diagrams.

Performance Criteria

(a) Identify correctly the circuit diagrams for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point.
(b) Describe clearly the operation of the circuits for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point.
(c) Draw correctly from given circuit diagrams, the wiring diagrams of both a two-way, and a two-way and intermediate switching arrangements each controlling two lighting points.
(d) State correctly the cross sectional area and colour of single-core cables in both two-way, and two-way and intermediate lighting circuits, to comply with the requirements of BS7671.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Demonstrate the skills and techniques used when installing, inspecting and testing circuit wiring enclosed in conduit systems.

Performance Criteria

(a) Install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way switching arrangement, using single-core PVC cable enclosed in a non-metallic conduit system, complying with the requirements of BS7671.
(b) Install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way and intermediate switching arrangement, using single-core PVC cable enclosed in a steel conduit system, complying with the requirements of BS7671.
(c) Carry out the inspection of both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system, in accordance with the requirements of BS7671.
(d) Carry out the appropriate testing of both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system, in accordance with the requirements of BS7671.
(e) Carry out the functional testing of both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system, correctly.

EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Performance evidence supplemented with an assessor observation checklist and written and/or recorded oral evidence should be produced to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria. The evidence should be produced under supervised, controlled conditions in a practical environment throughout the duration of the Unit.

Candidates should be permitted to use the Wiring Regulations BS7671 as a reference document throughout the assessment.

An appropriate form of assessment could be a single, holistic practical assignment which incorporates all the Outcomes and Performance Criteria.

Candidates should be presented with two ‘installation specifications’ for the assessment of this Unit:

(i) a conduit system comprising of non-metallic conduit and a circuit diagram showing two lighting points controlled by a two-way switching arrangement
(ii) a conduit system comprising of steel conduit and a circuit diagram showing two lighting points controlled by a two-way and intermediate switching arrangement

The wiring systems should be connected to the energy supply through a consumer’s Unit having appropriate circuit protection.

National Unit Specification: statement of standards (cont)

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From this information contained in the 'specifications' the candidate should produce a wiring system for each specification in order to:

- identify 20mm, 25mm and 32mm galvanised and black enamelled steel conduit and 20mm and 25mm non-metallic conduit and their accessories to include conduit boxes, saddles, couplings lockrings, serrated washers and bushes
- demonstrate the techniques of measuring, cutting, bending (two at 90^{o}), setting and threading (steel only) in both non-metallic and steel conduit to given dimensions
- demonstrate the assembly and installation of conduit systems using non-metallic and steel conduit to given specification requirements and dimensions
- identify correctly the circuit diagrams for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point
- describe accurately the operation of the circuits for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point
- draw correctly from given circuit diagrams, the wiring diagrams of both the two-way and the two-way and intermediate switching arrangements, each controlling **two** lighting points
- state correctly the cross sectional area and colour of single-core PVC cables in two-way, and two-way and intermediate lighting circuits, to comply with the requirements of BS7671 (no calculations required)
- install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way switching arrangement, using single-core PVC cable enclosed in a non-metallic conduit system, complying with the requirements of BS7671
- install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way and intermediate switching arrangement, using single-core PVC cable enclosed in a steel conduit system, complying with the requirements of BS7671
- inspect both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system, using a checklist provided
- carry out continuity, insulation resistance and polarity testing only for both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system, in accordance with the requirements of BS7671
- carry out the functional testing of both the two-way controlled lighting circuit enclosed in a non-metallic conduit system and the two-way and intermediate controlled lighting circuit enclosed in a steel conduit system to ensure they operate correctly

In addition to the production of the wiring systems as specified above, the candidates should also provide written and/or recorded oral evidence taken at a single assessment event lasting no more than 45 minutes, under controlled, supervised conditions which demonstrate an ability to:

- state three advantages and three limitations of both non-metallic and steel conduit systems
- identify four BS7671 requirements for conduit systems and single-core PVC wiring
- interpret two BS7671 requirements for conduit and conduit systems
- interpret two BS7671 requirements for single-core PVC wiring enclosed in conduit
- describe the operation of two-way and two-way and intermediate controlled lighting circuits

(Candidates should have access to the BS7671 Wiring Regulations publication during this assessment event).

National Unit Specification: support notes

UNIT Installation of Conduit Systems (SCQF level 6)

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 is an optional Unit within the National Qualification Group Award in Electrical Engineering at SCQF level 6 but may be offered on a free-standing basis.

The aim of this Unit is to develop candidate's knowledge and understanding of conduit systems and to develop also their fabrication and installation skills.

The Unit will enable candidates to develop their understanding of the techniques of conduit installation in relation to the requirements of the Wiring Regulations BS 7671. It will also give candidates an understanding of circuit and wiring diagrams and develop their ability to wire circuits using single-core PVC cables. Candidates will also be introduced to circuit inspection and testing and be provided with opportunities to carry out basic circuit testing procedures.

The tutor MUST ensure that the candidate works safely at all times and that the wiring arrangements have been tested and are correct, prior to the circuits being energised.

It would be an advantage to deliver this Unit in conjunction with the Unit *Inspection and Testing of Electrical Installations* at SCQF level 6.

This Unit has links with the technology Units in the National Qualification Group Award in Electrical Engineering and may be delivered as part of the suite of 'Wiring System' Units.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This Unit should be delivered in a practical environment and should encourage candidates to become familiar with the terminology of the conduit installations, wiring techniques and inspection and testing procedures.

Opportunities should be provided to allow candidates to develop their practical skills in the fabrication and installation of conduit wiring systems.

This practical approach should be continued to allow candidates to develop their interpretation of wiring and circuit diagrams and their ability to work between these. Basic installation inspection and testing procedures should also be carried out by candidates undertaking this Unit.

The requirements of the relevant Wiring Regulations BS7671 should be taught in conjunction with the development of the candidate's skills and understanding of conduit systems.

National Unit Specification: support notes (cont)

UNIT Installation of Conduit Systems (SCQF level 6)

Candidates should be able to identify the tools used in the construction of conduit and wiring systems and be taught their correct use. They should also be familiar with test instruments and their uses.

It is important that this Unit is delivered in a practical manner which develops the candidate's skills and understanding of conduit systems, circuit and wiring diagrams and inspection and testing procedures along with the appropriate requirements of BS7671.

The Outcomes should be delivered in the sequence given in the 'statement of standards'. The practical aspects of these Outcomes should be demonstrated to candidates with the reasons for particular techniques being fully explained. Candidates should then be given opportunities to practice these techniques.

Tutors MUST always ensure that candidates work in a safe manner and the Health and Safety workshop procedures of the centre should be continually emphasized and implemented.

Tutors MUST also satisfy themselves that ALL circuit wiring produced by candidates has be inspected and tested in accordance with the requirements of BS7671 and that NO circuit is connected to the supply voltage until these requirements have been fully met.

It is recommended that the supply voltage used to energise candidate circuits is of a suitable safe value.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

All aspects of the Core Skill of *Problem Solving* will be developed and enhanced as candidates apply their knowledge and understanding to a complex practical task. A high level of creative thinking is involved in the interpretation of installation specifications. Candidates must translate given information to produce a wiring system, assemble fabricated sections and install and terminate the wiring for a lighting circuit. Safety regulations and requirements must be adhered to as work is planned, organised and completed efficiently. Discussion with the assessor could support analytical review of approaches taken to achievement.

As they demonstrate effective working practice candidates perform a series of complex calculations and measurements, assembling and installing to given specification requirements and dimensions and interpreting and producing relevant wiring diagrams. Numeracy skills will be naturally enhanced, with a focus on the practical application of number and graphics. Formative activities should be designed around electrical engineering contexts.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of 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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

National Unit Specification: support notes (cont)

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The assessment of this Unit could take the form of a 'Practical Assignment' which extends over the duration of the Unit.

This assignment could contain the four elements specified in the Unit Outcomes ie

- interpreting the requirements for conduit systems and single-core PVC wiring in terms of the Wiring Regulations BS7671 state the advantages and limitations of conduit systems
- fabrication, assembly and installation of conduit systems
- interpreting wiring requirements from circuit diagrams
- installing, inspecting and testing circuit wiring enclosed in conduit systems

These four elements could be assessed by one practical assignment and written and/or recorded oral evidence,with the achievements of each element being clearly recorded for each candidate.

The practical assignment could be conducted in a workshop environment under supervised and controlled conditions.

The written and/or recorded oral evidence could be gathered by means of a short-answer and/or multi-choice question paper conducted under controlled, supervised conditions.

Candidates should be allowed access to the Wiring Regulations BS7671 for reference purposes

The Health and Safety of candidates must be paramount at all times and the tutor must be responsible for ensuring that all wiring carried out for assessment purposes is of a sufficiently high standard that it meets all the necessary BS7671 requirement prior to connection of the supply voltage.

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)**.