



National Unit Specification: general information

UNIT Low Voltage Distribution Systems (SCQF level 6)

CODE F5J1 12

SUMMARY

This Unit is intended for candidates with little or no prior knowledge of electrical low voltage (LV) distribution systems but who wish to gain knowledge of such systems.

The aim of this Unit is to develop candidate's knowledge and understanding of LV distribution supply systems, industrial LV distribution systems and domestic LV distribution systems.

Candidates will learn the layout of High Voltage (HV) to Low Voltage (LV) electrical substations, design factors for LV distribution supply systems, supply regulations and LV distribution feeder arrangements. Candidates will be given the opportunity to explain distribution equipment at the intake position for both domestic and industrial customers, the operation of LV circuit breakers, the isolation and protection of LV distribution systems, bonding and earthing requirements and BS7671 requirements.

This Unit is designed for candidates who are seeking a career as an electrical or multi-disciplinary engineering maintenance technician in the power utility industry or large industrial complex or the electrical installation industry.

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

OUTCOMES

- 1 Explain LV distribution supply systems.
- 2 Explain LV distribution within industrial premises.
- 3 Explain LV distribution within domestic premises.

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

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:

- ◆ Communication (SCQF level 6)

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

National Unit Specification: statement of standards

UNIT Low Voltage Distribution 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

Explain LV distribution supply systems.

Performance Criteria

- (a) Sketch and describe clearly the layout and components of a HV/LV distribution substation.
- (b) Interpret correctly the regulations for LV distribution supply systems.
- (c) Explain clearly design factors for LV distribution supply systems.
- (d) Explain correctly LV distribution feeder arrangements.

OUTCOME 2

Explain LV distribution within industrial premises.

Performance Criteria

- (a) Describe clearly the equipment at the intake position of a LV distribution system on industrial premises.
- (b) Explain clearly the need for isolation and protection equipment for industrial LV distribution systems.
- (c) Explain correctly the operation of LV circuit breakers.
- (d) Explain correctly the need for load balancing within industrial premises.
- (e) Interpret correctly the BS7671 requirements for a given LV distribution system supplying motive load.

OUTCOME 3

Explain LV distribution within domestic premises.

Performance Criteria

- (a) Describe clearly the equipment at the intake position of a LV distribution system on domestic premises.
- (b) Explain correctly the operation of domestic distribution units.
- (c) Explain clearly the bonding and earthing requirements of a domestic premise.
- (d) Interpret correctly the BS7671 requirements for a given LV distribution system.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Outcomes 1, 2 and 3:

Written and/or recorded oral evidence is required which demonstrates that the candidate has achieved Outcomes 1, 2 and 3 to the standards specified in the Outcomes and Performance Criteria. This evidence should be obtained under controlled, supervised conditions.

Outcomes 1, 2 and 3 may be assessed on an individual basis or as a single assessment covering all three Outcomes. The total assessment for Outcomes 1, 2 and 3 should be no longer than two hours and conducted under closed-book conditions however candidates should be permitted to use the Wiring Regulations BS7671 as a reference document for the assessment(s).

The assessment parameters are as follows:

With regard to Outcome 1:

- ◆ **three** regulations from the Electricity Safety, Quality and Continuity Regulations 2002 relating to LV distribution assets
- ◆ **three** factors from voltage standards, after diversity maximum demand, capacity during emergency conditions, unexpected load growth, safety and environmental considerations, security of supply and economics for either a rural or an urban distribution network
- ◆ **two** advantages and **two** limitations of ring **and** radial distribution systems to be stated

With regard to Outcome 2:

- ◆ intake position equipment to include **four** from the following: Three Phase incoming cable, Triple Pole and Neutral (T P and N) Cut-out, LV circuit breaker (or T P and N Main Switch), LV Busbar Chamber, T P and N distribution switch fuses, T P and N distribution boards, sub distribution boards and Current Transformer (CT) metering panel
- ◆ **three** LV distribution requirements of BS7671 to be interpreted in relation to motive load

With regard to Outcome 3:

- ◆ intake position equipment to include Single Phase incoming cable, Single Phase and Neutral (S P and N) cut out fuse, consumer Unit or distribution board and meter
- ◆ **three** LV distribution requirements of BS7671 to be interpreted

National Unit Specification: support notes

UNIT Low Voltage Distribution 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 also be offered on a free-standing basis.

The aim of this Unit is to develop the candidate's knowledge and understanding of LV distribution systems including the design factors for LV distribution supply systems, the supply regulations, the layout of an HV/LV electrical substation and distribution systems within industrial and domestic premises. Candidates will be able to describe the equipment at the intake position needs of LV distribution systems for both domestic and industrial customers and explain the operation of circuit breakers and the isolation and protection of LV distribution systems.

The content and context of this Unit should provide candidates with an overview of low voltage distribution systems and should emphasise the Electricity Safety, Quality and Continuity 2002 regulations and also BS7671 requirements.

Successful completion of this Unit enhances the employability skills for candidates to gain employment in the power utility sector or an industrial employer with electrical distribution systems or the electrical installation industry.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Outcomes are delivered in the following order: Outcome 1, Outcome 2, and Outcome 3. An organised visit to a distribution substation and LV switch room would be beneficial to the candidates in achieving the Outcomes of this Unit. Visual examination of distribution equipment and component parts such as LV voltage cables, LV switchgear are recommended.

Delivery of the Unit content could utilize relevant industrial case studies, and drawings/layouts of practical systems. The use of relevant videos or DVD recordings showing distribution systems and equipment, and the requirements of electrical installations would also be appropriate.

Although much of the content of this Unit is descriptive it should be delivered in an environment which relates to the topic of electrical distribution systems. This could be in an electrical workshop or classroom setting where visual aids place emphasis on such electrical distribution systems.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The need of candidates to interpret regulations and information relating to electrical distribution systems and the requirement to produce a layout diagram and describe systems showing the component parts of electrical systems in a clear and logical manner, provide the candidate with opportunities to develop both Written and Oral Communication skills.

National Unit Specification: support notes (cont)

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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)*.

Outcomes 1, 2, and 3 may be assessed on an individual basis or as a combination of Outcomes (eg Outcome 1 and 2 together and Outcome 3 separately) or as a single assessment covering all three Outcomes.

The assessment paper should comprise of a combination of short answer, restricted response and structured questions to allow candidates to display their knowledge of LV distribution supply systems and distribution systems within industrial and domestic premises.

This evidence should be obtained under controlled, closed-book supervised conditions.

The total assessment time for Outcomes 1, 2 and 3 should be no longer than two hours.

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

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).