

Higher National Unit Specification

General information for centres

Unit title: Electrical Safety

Unit code: DN4L 34

Unit purpose: This Unit is designed to enable candidates to develop knowledge and competence related to safe working practices and work permits. The Unit is intended to raise the candidate's awareness of health and safety practice and to provide opportunities to demonstrate the operation of permit-to-work systems.

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

1. Explain the features of an operational plan for safe working on electrical systems.
2. Explain the features of electrical distribution and the need for protection and isolation for safe working on 'dead' systems.
3. Explain the features of a permit-to-work system appropriate to the safe practices of working on an isolated electrical system.
4. Produce permit-to-work documentation for safe working on isolated electrical systems to current standards

Credit points and level: 1 HN 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 Access 1 to Doctorates.*

Recommended prior knowledge and skills: Candidates should have a broad knowledge and understanding of electrical distribution and control, overcurrent protection and installation design for electrical systems. This may be evidenced by the possession of the following HN Units: DG54 34 Single Phase A.C. Circuits, DN47 34 Three Phase Systems, DN3W 34 Electricity Power Systems. 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 Higher
- ◆ Written Communication (writing) at Intermediate 1
- ◆ Critical Thinking at Higher
- ◆ Working with Others at Intermediate 2

General information for centres (cont)

Context for delivery: This Unit was developed for the HNC and HND Electrical Engineering awards. If the Unit is to be used in another group award, it is recommended that it be taught and assessed in the context of that particular group award

Assessment: The assessment for Outcomes 1, 2 and 3 of this Unit should be combined together into one written assessment paper. This paper should be taken by candidates at one single assessment event that should last one and a half hours. The assessment paper should be composed of a suitable balance of short answer, restricted response and structured questions. This assessment should be conducted under controlled, supervised conditions.

The assessment for Outcomes 4 should form a practical exercise in which candidates are required to complete permit-to-work documentation for safe working on an isolated section of an electrical system. Candidates will be provided with blank permit-to-work documentation and be expected to complete the appropriate information and details.

The first assessment (Outcomes 1, 2 and 3) should be carried out after delivery of Outcome 3 and the second assessment (Outcome 4) should be carried out at the end of the delivery of this Unit.

Higher National 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

Explain the features of an operational plan for safe working on electrical systems

Knowledge and/or skills

- ◆ Dangers of electricity
- ◆ Concepts of Hazard and Risk.
- ◆ Features of a Risk Assessment.
- ◆ Awareness of the Responsibilities of personnel under the provision of the HSW Act 1974 and the Electricity at Work Regulations (EAWR) 1989
- ◆ Awareness of the need for safe isolation procedures.
- ◆ Appreciation of the need for safe working practices.
- ◆ Features of a typical Operational Plan for safe working on an electrical system.

Outcome 2

Explain the features of electrical distribution and the need for protection and isolation for safe working on 'dead' systems.

Knowledge and/or skills

- ◆ Distribution system including control equipment, overcurrent protection devices, isolation and switching equipment.
- ◆ Earthing and the earth fault loop path.
- ◆ The use of residual current devices for protection and isolation of the system.
- ◆ Documentation and plans of relevant distribution network.
- ◆ Features of safe isolation and 'Locking Off' procedures
- ◆ The use of warning notices for 'isolated' and 'non-isolated' sections of the system.
- ◆ The use of test and proving instruments.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Safety

Outcome 3

Explain the features of a permit-to-work system appropriate to the safe practices of working on an isolated electrical system.

Knowledge and/or skills

- ◆ Purpose of a Permit-to-Work system
- ◆ Details to be included on a Permit-to-Work.
- ◆ The need for supervisory personnel and the identification of their specific duties under the permit-to work.
- ◆ The need to ensure that all supervisory line responsibilities are securely maintained throughout the work.
- ◆ Identification of all potentially dangerous substances e.g. gas, fumes vapour etc. and the procedures to ensure that the work environment is free from dangerous substances.
- ◆ Identification of all potentially hazardous work activities to be carried out under the permit-to-work and the measures required to minimise risk due to potentially hazardous work activities.
- ◆ Procedures to ensure that all equipment, circuits, and control devices associated with the work are 'dead' and are correctly isolated.
- ◆ The need to ensure that a Permit-to-Work is issued for a specific task only and is cancelled on completion of that task.

Evidence Requirements

Evidence for the knowledge and /or skills in Outcomes 1 to 3 will be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the knowledge and skills items in all three Outcomes. In any assessment of the Outcomes **four out of seven** knowledge and/or skills items should be sampled from Outcome 1, **four out of seven** knowledge and skills items from Outcome 2 and **five out of eight** knowledge and skills items for Outcome 3.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of four out of seven knowledge and/or skills items from Outcome 1, four out of seven knowledge and/or skills items from Outcome 2 and five out of eight knowledge and skills items from Outcome 3 are required each time the Unit is assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Safety

Outcome 1

- ◆ Describe the dangers associated with electricity
- ◆ Describe the distinction between Hazard and Risk.
- ◆ Describe the features of a risk assessment exercise.
- ◆ Describe the responsibilities of personnel under the provision of the HSW Act 1974 and the Electricity at Work Regulations (EAWR) 1989
- ◆ Identify the need for safe isolation procedures.
- ◆ Outline the need for safe working practices to be carried out.
- ◆ Describe the features of a typical Operational Plan for safe working on an electrical system.

Outcome 2

- ◆ Describe a distribution system including control equipment, overcurrent protection devices, isolation and switching equipment.
- ◆ Explain the need for Earthing and identify the earth fault loop path.
- ◆ Explain the use of residual current devices for protection and isolation of the system.
- ◆ Describe the use of documentation and plans of a relevant distribution network.
- ◆ Describe the practice of safe isolation and 'Locking Off'
- ◆ Explain the use of warning notices for 'isolated' and 'non-isolated' sections of the system.
- ◆ Explain the use of test and proving instruments.

Outcome 3

- ◆ Explain the purpose of a Permit-to-Work system
- ◆ Outline the details to be included on a Permit-to-Work.
- ◆ Outline the need for supervisory personnel and the identification of their specific duties under the permit-to work.
- ◆ Outline the need to ensure that all supervisory line responsibilities are securely maintained throughout the work.
- ◆ Explain the need to identify all potentially dangerous substances e.g. gas, fumes vapour etc. and the procedures to ensure that the work environment is free from dangerous substances.
- ◆ Explain the need to identify all potentially hazardous work activities to be carried out under the permit-to-work and the measures required to minimise risk due to potentially hazardous work activities.
- ◆ Explain the procedures to ensure that all equipment, circuits, and control devices associated with the work are 'dead' and are correctly isolated.
- ◆ Explain the need to ensure that a Permit-to-Work is issued for a specific task only and is cancelled on completion of that task

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be provided with current codes of practice or other relevant legislative documentation for use during the assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Safety

Assessment guidelines

The assessment for Outcomes 1 to 3 should be combined together to form one assessment paper. This single assessment paper should be taken at a single assessment event lasting one and a half hours and carried out under supervised, controlled conditions. Such a paper should be composed of an appropriate balance of short answer, restricted response and structured questions. This assessment should be taken after delivery of Outcome 3.

Outcome 4

Produce permit-to-work documentation for safe working on isolated electrical systems to current standards.

Knowledge and/or skills

- ◆ Relevant equipment and circuits are located from plans and documentation.
- ◆ Appropriate earthing and isolation points are located.
- ◆ Implementation of safe isolation, testing of equipment and proving of test equipment.
- ◆ Appropriate precautions to minimize risk due to the implementation of hazardous work activities.
- ◆ Relevant and complete information is recorded on the Permit-to-Work documentation.
- ◆ Permit-to-Work documentation is correctly authorised and endorsed by the appropriate personnel.

Evidence Requirements

Evidence for the knowledge and/or skills in the Outcome will be provided by the candidate producing permit-to-work documentation for safe working on isolated electrical equipment and demonstrating the procedures of such a permit-to-work system.

This exercise is intended to be undertaken on a simulated system operating at a safe level of working voltage. The permit-to-work should apply to a specific maintenance operation on an item of electrical equipment where other 'Live' equipment is likely to be present.

A candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ Locate relevant control/protection equipment and circuits on plant as detailed on plans and from documentation.
- ◆ Locate appropriate earthing and isolation points.
- ◆ Implement safe isolation, testing of equipment and proving of test equipment.
- ◆ Implement appropriate precautions to minimize risk due to hazardous work activities being carried out
- ◆ Record relevant and complete information on the Permit-to-Work documentation.
- ◆ Ensure that the permit-to-work documentation is correctly authorised and endorsed by the appropriate personnel.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Safety

This assessment exercise should be based on the features of the permit-to-work scheme outlined in Outcome 3 and the required documentation should incorporate these features.

Evidence should be generated through assessment under controlled, supervised conditions. Assessment should be conducted under closed-book conditions and, as such, candidates must not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be provided with current codes of practice or other relevant legislative documentation for use during the assessment.

Assessment guidelines:

The assessment exercise for Outcome 4 will specify that the work is intended to be undertaken on a simulated system operating at a safe level of working voltage. The permit-to-work should apply to a specific maintenance operation on an item of control equipment e.g. electric motor control gear, in an industrial environment where other 'Live' equipment is likely to be present.

It is important that Centres develop a checklist to record the assessment requirements for each of the knowledge and/or skills items.

The assessment exercises should be carried out under controlled and supervised conditions and centres should ensure that the evidence generated is the candidate's own work.

The assessment of the Outcome 4 should be undertaken at the end of the Unit

Administrative Information

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Unit title: Electrical Safety

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Higher National Unit specification: support notes

Unit title: Electrical Safety

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 their knowledge and competence in the following areas:

1. Operational plans for safe working on electrical systems.
2. Protection and isolation for safe working on 'dead' systems.
3. Features of a permit-to-work system appropriate to the safe practices of working on isolated electrical distribution networks.
4. Procedures under a permit-to-work for safe working on isolated electrical equipment to current standards

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 decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics, it is recommended that they do so since the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

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

1. Explain the features of an operational plan for safe working on electrical systems (6 hours)

The 'operational plan' features should comply with current Codes of Practice and legislation:

- ◆ Awareness of dangers to include fire and shock.
- ◆ Distinction between Hazard and Risk.
- ◆ Risk Assessment procedures.
- ◆ Responsibilities of personnel including employers, employees, trainees etc. under the provision of the HSW Act 1974 and the Electricity at Work Regulations (EAWR) 1989
- ◆ The need to plan work and assess risks for safe dead and live working
- ◆ The need for safe isolation procedures.
- ◆ Definition of Authorised Person.
- ◆ The need to restrict access to work areas.
- ◆ The need for safe working practices.
- ◆ Features of a typical Operational Plan for safe working on an electrical system.

Higher National Unit specification: support notes (cont)

Unit title: Electrical Safety

2. Explain the features of electrical distribution and the need for protection and isolation for safe working on ‘dead’ systems (10 hours)

The delivery of this Outcome should illustrate how elements of an electrical system may be safely isolated to allow safe working on a ‘dead’ system.

- ◆ Features of a distribution system including control equipment, overcurrent protection devices, isolation and switching equipment.
- ◆ Principles of earthing and the earth fault loop path.
- ◆ The use of residual current devices for protection and isolation of the system.
- ◆ Documentation and plans of relevant distribution network.
- ◆ The need to identify the appropriate section of the network to be isolated.
- ◆ Practice of isolation and ‘Locking Off’
- ◆ The need for warning notices for ‘isolated’ and ‘non-isolated’ sections of the system.
- ◆ The need for and use of test and proving instruments.
- ◆ The need for written procedures indicating the sequence of a safe isolation procedure.
- ◆ Features of a safe isolation procedure.

3. Explain the features of a permit-to-work system appropriate to the safe practices of working on an isolated electrical system. (8 hours)

The generic features of a Permit-to-work system should be highlighted in this Outcome and reference should be made to the fact that variations will exist with individual Companies.

- ◆ Purpose of a Permit-to-Work system for ‘dead’ working in the vicinity of ‘live’ equipment
- ◆ Features of a Permit-to-Work system.
- ◆ Details to be noted on a Permit-to-Work.
- ◆ The need for supervisory personnel and the identification of their specific duties under the permit-to work.
- ◆ The need to ensure that all supervisory line responsibilities are securely maintained throughout the work.
- ◆ Identification of all potentially dangerous substances which might be present in the work area. e.g. gas, fumes vapour etc.
- ◆ Procedures to ensure that the work environment is free from dangerous substances.
- ◆ Identification of all potentially hazardous work activities to be carried out under the permit-to-work.
- ◆ Measures to minimise risk due to potentially hazardous work activities are identified.
- ◆ Procedures to ensure that all equipment, circuits, and control devices associated with the work are ‘dead’ and are correctly isolated.
- ◆ The need to ensure that a Permit-to-Work is issued for a specific task only and is cancelled on completion of that task.

Higher National Unit specification: support notes (cont)

Unit title: Electrical Safety

4. Produce permit-to-work documentation for safe working on isolated electrical systems to current standards (16 hours)

This Outcome is intended to be delivered in a practical manner using a simulated system operating at a safe level of working voltage.

- ◆ Production of a relevant Permit-to-Work for work to be carried out on an item of control equipment.
- ◆ Location of relevant control/protection equipment and circuits on plant as detailed on plans and from documentation.
- ◆ Location of appropriate isolation points.
- ◆ Location of appropriate earthing points.
- ◆ Implementation of safe isolation, testing of equipment and proving of test equipment.
- ◆ Implementation of secure locking procedures and the provision for retaining keys in a secure manner.
- ◆ Fixing of warning notices in appropriate locations and on relevant equipment.
- ◆ Appropriate precautions to minimize risk due to the implementation of hazardous work activities.
- ◆ Relevant and complete information is recorded on the Permit-to-Work documentation.
- ◆ Permit-to-Work documentation is correctly authorised and endorsed by the appropriate personnel.

Guidance on the delivery and assessment of this Unit

The Unit has been developed within the Mandatory section of the HNC and HND Electrical Engineering awards. The Unit is intended to be delivered in conjunction with the HNC Units: Inspection and Testing of Low Voltage Electrical Installations and Electrical Installation Skills, and in addition to these, the following HND Units: Electrical Installation Design: Computer Aided, Electrical Installation Design and Industrial Plant Maintenance.

Delivery of this Unit should relate to Current Codes of Practice and legislation including:

- ◆ Health and Safety at Work Act, 1974 (HSW Act)
- ◆ Electricity at Work Regulations 1989
- ◆ BS 7671: IEE Requirements for Electrical Installations
- ◆ HSEE- Publication HS(G)85 Electricity at Work – Safe Working Practices
- ◆ HSE – Publication HSR25 Memorandum of guidance on the Electricity at Work Regulations

Details on approaches to assessment are given under Evidence requirements and Assessment guidelines under each Outcome in the Higher National Unit Specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

Higher National Unit specification: support notes (cont)

Unit title: Electrical Safety

Open learning

This Unit may be delivered by distance learning however, due to the practical nature of Outcome 4, a considerable degree of centre support will be required. With regard to assessment, planning would be required by the centre to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that the assessments were conducted under controlled, supervised conditions.

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

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. 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. For information on these, please refer to the SQA document *Guidance Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website www.sqa.org.uk.

General information for candidates

Unit title: Electrical Safety

This Unit has been designed to allow you to develop an appreciation of electrical safety and to further your knowledge and understanding of the requirements and features of permit-to-work systems in relation to electrical systems.

The Unit will provide you with an appreciation of the need for assessing the risks associated with working with electrical systems and equipment and the importance of ensuring that such systems are properly isolated from the supply prior to any work being carried out. It introduces the concept of an 'operational plan' for safe working on electrical systems and develops the features of such a plan.

It is important that, before you carry out any work on an electrical system, you understand the features of such a system and how its component parts work together. The Unit develops this theme in Outcome 2 which describes the features of such a distribution system and the features of a safe isolation procedure on any relevant section of the network.

Outcome 3 allows you to develop your understanding of permit-to-work systems and highlights the responsibilities and duties of responsible personnel under a permit-to-work scheme.

By the time you have completed Outcome 4, you will have carried out a safe isolation procedure on a simulated electrical distribution system and will have completed the relevant documentation under the permit-to-work scheme for safe working on the network.

On completion of this Unit you should have a good appreciation of the need for and requirements of electrical safety schemes and will be able to implement a generic permit-to-work system.

The formal assessment of this Unit is in two parts. Firstly, you will be expected to undertake a written assessment on your appreciation of the features of operational plans, electrical distribution systems and permit-to-work schemes and, secondly, you will be required to produce completed permit-to-work documentation after having successfully isolated a section of a simulated electrical network. A blank permit-to-work proforma will be provided for you to record the relevant information.

The first of these two assessments will be taken after Outcome 3 has been delivered and the second assessment will be taken at the end of the Unit. Both assessments will be carried out under supervised and controlled conditions. You will not be allowed to consult notes, textbooks etc. during the assessment exercises however you will be permitted to use current codes of practice or other relevant legislative documentation.