

National Unit Specification: general information

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| UNIT | Basic Electrical Installation Skills (Intermediate 2) |
| NUMBER | D9AH 11 |
| COURSE | Electrical Installation Fundamentals (Intermediate 2) |

SUMMARY

This unit has been designed to introduce candidates to the skills and safe working practices required when installing electrical equipment. It will focus on the formation of practical lighting and socket outlet circuits. It incorporates planning where electrical diagrams have to be interpreted and electrical equipment has to be identified and correctly selected. The completed practical exercises have to be evaluated to ensure they function correctly and comply with all the safety requirements relevant to Intermediate 2.

OUTCOMES

- 1 Assemble equipment to form electrical circuits.
- 2 Perform testing procedures on electrical systems.

RECOMMENDED ENTRY

While entry to this course is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Mathematics and either Technological Studies or Physics at Grade 3 and 4 (General level) Standard Grade
OR
- Equivalent National Units.

Administrative Information

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| Superclass: | XJ |
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National Unit Specification: general information (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2 (6 SCOTCAT points*) at SCQF level 5.

*SCOTCAT 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 SCOTCAT 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 or core skills components in this unit.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Basic Electrical Installation Skills (Intermediate 2)

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 the Scottish Qualifications Authority.

OUTCOME 1

Assemble equipment to form electrical circuits.

Performance criteria

- a) Hazards and control measures for safe working practices are correctly identified.
- b) Manufacturer's catalogues are used to select electrical equipment.
- c) Plastic enclosures and PVC sheathed cables are correctly assembled and installed to form wiring systems.
- d) Electrical diagrams and BS symbols are correctly interpreted when forming lighting and socket outlet circuits.
- e) Standard installation wiring practices for electrical safety are correctly identified.

EVIDENCE REQUIREMENTS

The candidate will be given the Installation Layout Diagram which is designed to measure the ability to interpret diagrams, identify and install electrical equipment to form lighting and socket outlet circuits. The practical exercises include the installation of PVC sheathed cables, plastic conduit and trunking wiring systems. A basic visual inspection schedule, highlighting good practices, has to be completed for each circuit.

The candidate will be required to:

- 1 Correctly identify three selected hazards and the control measures required to ensure a safe system of work when installing electrical equipment (risk assessment report).
- 2 Use manufacturers' catalogues to identify reference numbers for selecting electrical equipment.
- 3 Assemble the equipment outlined in the Installation Layout Diagram to form the following three final circuits.
 - (i) Install PVC sheathed cables to form a loop in lighting circuit.
 - (ii) Assemble plastic conduit and form a loop in lighting circuit.
 - (iii) Install PVC sheathed cables and plastic trunking and form a socket outlet radial circuit.

The practical lighting exercises incorporate 1-way and 2-way control for both wiring systems.

The circuits should incorporate bayonet cap and Edison screw lampholders. The radial circuit should include two socket outlets and one fused connection unit with a connected load.

National Unit Specification: statement of standards (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

The candidate will be required to:

- Mark out position of equipment and cable runs.
- Secure backboxes in position with the correct fixing device.
- Install the correct type and size of PVC sheathed cable for the lighting circuit.
- Install the correct type and size of PVC sheathed cable for a 20A radial circuit.
- Form bends and off-sets in PVC sheathed cable systems.
- Select supports and secure PVC sheathed cables.
- Terminate PVC sheathed conductors at accessories when forming a lighting and socket outlet circuit.
- Identify, sleeve and terminate protective conductors at electrical equipment.
- Fabricate, assemble and secure plastic conduit and trunking systems.
- Install single core cables and terminate conductors at electrical accessories when forming a lighting circuit within a plastic conduit system.
- Select the correct rating of protective device for each final circuit.
- Complete the visual inspection schedule for each circuit installed.

Satisfactory achievement of the outcome will be based on the candidate producing:

- (i) a completed report for safe systems of work given in Table 1;
- (ii) the correct catalogue reference numbers for the selected electrical equipment given in Table 2;
- (iii) a completed visual inspection schedule given in Table 3 for the practical exercises contained in the Installation Layout Diagram.

OUTCOME 2

Perform testing procedures on electrical systems.

Performance criteria

- a) Instrument selected for each test is correct.
- b) Measured test results and readings are correctly recorded.
- c) Compare and confirm test values with relevant criteria.
- d) Circuits function correctly when connected to an electrical supply.
- e) Electrical faults on systems are correctly identified.

Evidence requirements

A test report for each circuit has to be completed before being connected to an electrical supply. All covers and enclosures have to be secured to ensure no live parts are exposed to touch.

The candidate will be required to complete a test report for the lighting and radial circuits constructed in Outcome 1.

National Unit Specification: statement of standards (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

To achieve this the candidate must:

- Select the correct instrument scale, test voltage range and measure the insulation resistance values of the final circuits.
- Confirm earth continuity requirements of each final circuit.
- Apply polarity checks to each final circuit.
- Record measured results and readings for each final circuit tested.
- Compare and identify unacceptable results.
- Test the function of each circuit by connection to an electrical supply.

Satisfactory achievement of the outcome will be based on the candidate completing the Test Report for all the circuits given.

An incorrect result, reading or circuit function should be considered as one that shows a lack of understanding rather than one caused by a lack of knowledge.

National Unit Specification: support notes

UNIT Basic Electrical Installation Skills (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

It is recommended that you refer to the SQA Arrangements document for the Intermediate 2 Electrical Installation Fundamentals course before delivering this unit.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

This unit will provide candidates with the introductory practical skills to be able to install equipment and form electrical circuits. It incorporates overriding safety factors, which ensure equipment is installed in a safe manner and systems are designed to minimise the risk from electric shock.

It is aimed at young people and adult learners who wish to enter the electrical contracting industry and/or progress to further studies in Electrical Installation or Electrical Engineering courses.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Safety regulations and safe working practices should be observed at all times.

- Safe systems of work and control measures are clearly identified.
- The risks of working with electricity are clearly explained.
- Safe touch voltages should be selected for all project work.
- Only a basic explanation between the two different light sources is required.
- Reference to regulations should only refer to good practice and relate to the candidates' Project Brief requirements.
- Good workmanship and proper materials shall always be used.
- A simplified form will allow candidates to record results when testing.
- Project represents an installation with no simulation except for voltage levels.
- Filament light sources to include bayonet cap and Edison screw lamp holders.

The candidate could be given a practical assignment, which would demonstrate the ability to assemble a range of electrical accessories to form practical lighting and socket outlet power circuits when connected to a safe working voltage. The practical exercises could be constructed around specific tasks where the candidate would produce wiring diagrams from an initial understanding of circuit diagrams. Wiring diagrams should be labelled and clearly indicate the function of the conductors.

Additional assignments should permit the candidate to recognise BS symbols and their function when interpreting electrical layout diagrams. The candidate should also be encouraged to use manufacturers' catalogues and lists when selecting electrical equipment. This should include protective equipment, accessories and cable types and sizes.

A mixture of non armoured sheathed cables and plastic enclosures can be used to form lighting and power circuits to comply with current practice. The candidate must demonstrate the techniques required to install sheathed cables, plastic conduit and mini trunking systems. Basic testing and fault finding should be encouraged to minimise the risks when using electricity. Each circuit can be formed separately providing that all the elements of the PCs are achieved.

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

The candidate must demonstrate a knowledge of bayonet and recommended Edison screw lamp holder terminating requirements. The application of filament and discharge luminaires in domestic or small installations (garages, house extensions etc.) should be briefly outlined.

Outcome 1

Standard installation wiring practices should include conductor preparation, terminating methods, conductor identification and earthing connections. Electrical safety factors should ensure that protective and single pole switching devices are only connected to the phase conductor. PVC sheathed cable and plastic enclosure layout procedures should be outlined and the correct supporting methods identified. Cable sizes and over current device ratings for standard lighting and socket outlet circuits are to be identified by reference to selected tables or information charts. Electrical diagrams (wiring, circuit and layout) and the use of BS symbols will be incorporated into the planning for the implementation of the Project Brief.

The following tasks will underpin the knowledge and understanding when installing electrical installation circuits:

- Completing a risk assessment when forming safe systems of work.
- Producing wiring diagrams for lighting circuits.
- Recognition of BS symbols and the function of layout diagrams.
- Identifying electrical equipment using manufacturers' catalogues, lists or information charts.
- Application of selected wiring systems.
- Forming 1-way and 2-way lighting circuits with PVC sheathed cables.
- Forming 1-way and 2-way lighting circuits in a plastic conduit system.
- Forming a socket outlet radial circuit with PVC sheathed cables and a plastic trunking system.
- Identifying protective devices, isolating devices and switch disconnectors.
- Functional earthing requirements: conductor preparation, sleeving and cross bonding if metal socket boxes are used.
- Visual inspection requirements to recognise good practice.
- Isolating procedures to be outlined to ensure a safe system when assembling electrical circuits.
- Correct use of hand tools: 1st fix assembly: 2nd fix terminations.

The tasks would include:

- Marking and laying out of equipment.
- Plastic enclosure layout: conduit and mini trunking systems.
- PVC sheathed cable layout and supports when forming a lighting and socket outlet circuit.
- Accessory fixing methods.
- Installing single core cables for lighting circuits.
- Cable preparation and conductor terminating methods: screw and crimping connections.

In assembling a circuit, the candidate should not be exposed to simulation, although a supply point may already be secured in position. The wiring systems could be assembled and secured to a wooden surface.

Outcome 2

Tests should be used to confirm that each circuit is electrically safe when connected to a supply. The candidate must not be exposed to live parts when the covers are removed.

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

The task would include:

- Outlining the dangers of electricity: shock, arcing and burns.
- Knowledge of purpose of testing.
- Using continuity and insulation resistance test instruments to record results.
- Recording insulation resistance values.
- Check circuits for earthing requirements.
- Check the requirements for polarity.
- Methods of recording and comparing test results in the schedule.
- Identifying different types of electrical faults: open and short circuit.
- Identifying and rectifying the cause of unsatisfactory test results.
- Functional testing of completed circuits.

Safety regulations and safe working practices should be observed at all times.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This practical unit should be taught mainly in a workshop since it requires recognising and installing electrical equipment to form lighting and socket outlet circuits. The circuits will be formed using PVC sheathed cable, plastic conduit and trunking wiring systems. It is essential that wiring diagrams can be interpreted when forming lighting circuits with 1-way and 2-way control. Installation techniques should be reinforced through continued example and practice. Manufacturers' catalogues should be used to underpin the knowledge required to recognise electrical accessories and control equipment. Good installation practices should be integrated within skill development to ensure wiring systems are correctly assembled and installed.

There should only be a minimum reference to basic cable tables or centre devised information charts for the circuits specified in the installation layout diagram. Practical examples in the application of wiring systems should be outlined in preparation for the selection of the Installation Project design brief. Further development in the use of electrical diagrams and BS symbols is essential in enhancing the knowledge and understanding of electrical systems.

Accident prevention control measures, identified by risk assessment procedures should be continually enforced throughout the practical skill development in the workshop. The use of test instruments is designed to underpin the basic requirement for electrical safety. Throughout the unit, standard design practices for cables, protection and control functions should be reinforced in preparation for the Installation Project.

Reference should be made to the other two units and Project within the Electrical Installation Fundamentals Intermediate 2 course of study.

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

| <i>Knowledge and Understanding</i> | <i>Contexts, applications, illustrations and activities</i> |
|---|--|
| 1 Identify control measures to ensure safe systems of work | Outline hazards in a workshop environment. Instruction - Information - Training 1 Working at height 2 Electricity - slips, trips and falls - electric shock control measures: control measures: • Supervision • Reduced voltage • Safe Access and Egress • Enclosures • Housekeeping • Isolation • Step ladders • Waste material disposal |
| 2 Know the difference between circuit diagrams and wiring diagrams | Tutorial supported by practical project |
| 3 Identify electrical accessories and equipment required for lighting and socket outlet power circuits | Demonstrations supported by practical projects Manufacturers' catalogues |
| 4 Recognise electrical symbols and their applications | Layout diagrams and their functions. Relate symbols to electrical accessories |
| 5 State the type, application and installation method of wiring systems to be installed | Tutorial and practical exercises. Example where systems are installed • Sheathed cables • Plastic conduit enclosures and accessories • Plastic trunking enclosures and accessories |
| 6 Recognise the tools required to install electrical systems (1 st fix and 2 nd fix) | Example in use of tools to enforce effective application when installing wiring systems |
| 7 Identify good electrical installation techniques and match them to the requirements of the practical projects | • Identification of conductors • Protection from mechanical damage • Terminating procedures: screw and crimping • Earthing: connections and sleeving • Circuit protection |
| 8 List the basic principles of electrical safety | Shock and Fire Protection • Standard cable types and sizes • Earthing function: exposed metalwork, main earthing terminal • Consumer switchgear: protective devices |
| 9 List the types of electrical faults | • Loss of supply • Cable termination – open circuit • Insulation failure – short circuit • Overload or fault/mcb or fuse operating • Equipment failure |
| 10 Perform testing procedures on system installed and compare results | Demonstration and practical activity • Isolation • Continuity checks – earth and polarity • Insulation tests • Take measurements and record results • Open circuit and short circuit faults |

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

| <i>Knowledge and Understanding</i> | <i>Contexts, applications, illustrations and activities</i> |
|---|---|
| 11 Know the difference between incandescent filament lamps and discharge fluorescent luminaries. Filament lamp caps. Luminaire selection. | Applications outlined <ul style="list-style-type: none">• Tungsten filament• Fluorescent tube• Edison screw• Bayonet cap |
| 12 Understand the minimum requirements for a final circuit | Integrate within practical project <ul style="list-style-type: none">• Supply source• Cables• Load• Protection• Control |

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Accident prevention control measures (risk assessment report) should include forming a safe system when working at height eg stepladders, identifying good housekeeping practices and the purpose of keeping traffic routes clear. The report should also incorporate the purpose of identifying worn tools and the risks when continuing to use them. Safe methods of disconnecting the electrical supply using isolating or switching devices have to be identified and recorded in the risk control report.

Outcome 1

The practical exercises outlined in the installation layout diagram have to be completed and visually inspected before being tested.

Completion of the assessor's checklist will confirm that the standards outlined for each circuit has been achieved.

The exercises incorporate an activity where the candidate has to identify electrical equipment. Catalogue reference numbers have to be identified and recorded in the report.

Three work activities are outlined and the candidate has to identify the hazards and control measures to ensure a safe system of work.

Satisfactory achievement of the outcome will be based on the candidate completing the exercises and the assignments and a checklist record which shows all elements of the PCs are achieved.

Outcome 2

The candidate will be given a test report, which is designed to record results and compare the values with standard circuit criteria. The tests for each circuit are to be completed before any circuit is connected to the electrical supply. The exercises must be carried out with the appropriate test instruments, which will underpin the precautions that have to be taken before any circuit is connected to an electrical supply.

The testing report is designed to measure the ability to select the correct instruments, range and scale and correctly compare the test results and readings obtained. The report will require the candidate to confirm the continuity of protective conductors and measure circuit insulation resistance values. Practical polarity checks should confirm that circuit breakers, fuses and single pole switches have only been connected to the live phase conductor.

National Unit Specification: support notes (cont)

UNIT Basic Electrical Installation Skills (Intermediate 2)

Satisfactory achievement of this outcome will be based on the candidate producing a completed report on the assignment and a checklist record which shows that all elements of the PCs are achieved.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, publication code AA0645/3).