

*This document contains the electrical level 2 units which will be utilised in the apprenticeship qualification **and** the progression qualification.*

Some further nonelectrical generic units to be added

DRAFT

Unit Ref: 201K Understand health and safety and environmental legislation in the building services engineering sector

Level:	2
GLH:	TBC

What is this unit about?

This unit covers the **knowledge and understanding** required for establishing and maintaining working practices and procedures across a specified range of building services engineering sector installation and/or maintenance activities that consider health and safety, the natural environment and the working environment. This would include identifying hazards and risks, applying appropriate procedures and working practices to protect yourself and others.

The learner will possess knowledge and understanding to be able to use building services engineering sector equipment, components, materials and substances effectively, efficiently, in accordance with the specification giving consideration to the natural environment and the working environment in terms of waste materials and if appropriate water usage.

Knowledge and understanding:

NOS outcome:

1. Appropriate industry standards and regulations

Scope and range

1.1 Sources of information

Range: Statutory regulations, Building Regulations, Industry standards, Manufacturer technical instructions.

Health and safety legislation: General legislation, construction specific legislation, Building services specific legislation

Health and safety guidance: non-statutory regulations, approved code of practice, Health and Safety Executive (HSE) Guidance Notes.

1.2 Health and safety/environmental legislation

Range: The Health and Safety at Work etc. Act, The Electricity at Work Regulations, The Management of Health and Safety at Work Regulations, Workplace (Health and Safety and Welfare) Regulations, Control of Substances Hazardous to Health (COSHH) Regulations, Working at Height Regulations, Personal Protective Equipment at Work Regulations, Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Control of Asbestos at Work Regulations, Environmental Protection Act, The Hazardous Waste Regulations, Pollution Prevention and Control Act, Control of Pollution Act, The Control of Noise at Work Regulations, The Waste Electrical and Electronic Equipment Regulations.

NOS outcome:

2. Your responsibilities in accordance with organisational procedures

Scope and range

2.1 Members of the construction team

Range: Construction team, employers (including employer representatives), designers, main contractors, sub-contractors, employees, self-employed (labour only), clients (customers).

2.2 Enforcing authorities

Range: Health and Safety Executive, Local Authority.

2.3 Control measures of inspectors

Range: Improvement notice, prohibition notice, powers of prosecution, role in providing advice and guidance.

NOS outcome:

3. The application, advantages and limitations of different working practices

3.1 Working practices

Range: competent persons, electrical safe isolation procedure, permits to work, selection and checking correct power tools, hand tools and portable electrical equipment, safe working practices with equipment and materials: portable power tools (e.g. cartridge gun, drills, grinders) signs and guarding, tools and materials storage facilities. Dangerous substances, e.g. cutting compounds and adhesives.

NOS outcome:

4. How to recognise materials and substances that can potentially be harmful

Scope and range

4.1 Common building materials and services components that may contain asbestos

Range: Flue, soil, rainwater pipes, gutters, tanks and cisterns, Artex, small gaskets and seals, bath panels/panelling, floor tiles, plaster and decorative finishes, in electrical accessories (flash guards and matting in fuse carriers and on distribution board covers).

4.2 The types of asbestos

Range: White asbestos (chrysotile), brown or grey asbestos (amosite), blue asbestos (crocidolite), asbestos cement materials.

4.3 Commonly encountered substances.

NOS outcome:

5. The documentation associated with the organisational procedures' requirements

Scope and range

5.1 The strategies used to prevent accidents during work activities

Range: Method statements, permit to work systems, risk assessments, safety notices, CSCS card and CSCS affiliated cards.

NOS outcome:

6. The organisational procedures for dealing with the presence of harmful materials and substances

Scope and range

6.1 The procedures that must be used to safely work with asbestos cement-based materials

Range: Work activities for licensed and unlicensed work, licensing requirements for asbestos removal organisations, safe disposal requirements, protection of the workforce and members of the public.

NOS outcome:

7. Where and how to locate relevant health and safety information needed to complete the installation and/or maintenance activity in accordance with organisational procedures

NOS outcome:

8. What constitutes a hazard or risk

Scope and range

8.1 Site hazards

Range: Construction sites (all property types), in industrial commercial premises (occupied and unoccupied refurbishment), in dwellings (occupied and unoccupied refurbishment) vehicle use (driving time limits, driving duress).

8.2 Common electrical dangers encountered

Range: Faulty electrical equipment, signs of damaged or worn electrical cables – power tools and property hard wiring system, trailing cables, proximity of cables to services pipework, buried/hidden cables, inadequate over-current protection devices, electric shock, burns, fires and explosions.

8.3 General hazards

Range: presence of dust and fumes, handling and transporting equipment or materials, contaminants and irritants, fire, working at height, hazardous malfunctions of equipment, improper use, maintenance and storage of tools and equipment, bacteria from vermin.

NOS outcome:

9. The methods for handling of hazardous materials and substances in accordance with organisational procedures

Scope and range

11.1 Commonly encountered substances.

NOS outcome:

10. The organisational procedures, suppliers' and manufacturers' instructions for safe use, maintenance, handling, transport and storage of:

- Tools, plant and access equipment
- Equipment and components
- Materials and substances

Scope and range

10.1 **Access equipment** to permit work at heights

Range; Step ladders, ladders, harnesses, roof ladders and crawling boards, mobile tower scaffolds, fixed scaffolds and edge protection, mobile elevated work platforms including scissor lifts and cherry pickers.

10.2 **Personal protective equipment (PPE)**

Range: Clothing protection including high visibility, eye protection, hand protection, head protection, foot protection, hearing protection, respiratory protection, vibration protection, harnesses.

10.3 Excavations and confined spaces.

NOS outcome:

11. The warning signs for hazardous materials and substances

Scope and range

11.2 How the hazards of some substances and mixtures can be identified from the labels on packaging

Range: Globally harmonised System (GHS) on the classification and labelling of hazardous substances and mixtures categorisation and hazard classes: physical hazards, health hazards, environmental hazards, the presentation of information (GHS pictogram and signal word).

NOS outcome:

12. The methods for the safe transport and/or disposal of waste material, substances and liquids in accordance with:

- Organisational procedures
- Suppliers' and manufacturers' instructions

Scope and range

12.1 How to deal with commonly encountered substances.

NOS outcome:

13. The organisational procedures relevant to reporting issues relating to:

- Health and safety
- Harmful substances and material
- Emergencies on site

Delivery advice (depth of content)

1

Learners will recognise the health and safety legislation and regulations and relevant guidance materials applicable to building services engineering work, they would also get an understanding of the legal status and relationship between the documents.

2

Learners will be able to identify the responsibilities of members of the construction team.

Learners will be aware of the types of procedures in an organisation and how these impact on them and who to ask or where to find these organisational procedures.

They will also develop an understanding of the HSE and the Local Authority's role in enforcing health and safety and the control measures of inspectors, including their role in providing advice and guidance

Learners will know why it is important to report any hazards to the environment that arise from work procedures. The actions to be taken in situations which exceed their level of responsibility for health and safety in the workplace. They will be able to specify appropriate responsible persons to whom health and safety and welfare related matters should be reported such as the employer, supervisor, customer/client, safety officers, health and safety executive/inspectors, trades union representative and environmental health officers.

3

Learners will understand safe working practices within the BSE environment and how these are applied and some of the limitations and advantages using specific practices.

4

Learners will be able to state the types of asbestos that may be encountered in the workplace and also the common building materials and services components that may contain asbestos.

5

Learners will be able to define strategies used to prevent accidents during work activities. They will have knowledge of PASMA requirements.

6

Learners will be able to define the procedures that must be used to safely work with asbestos cement-based materials.

7

Learners will be able to state how to obtain health and safety information and documentation relevant to their work and where this is obtained from.

8

Learners will understand what is meant by the terms hazard and risk in relation to health and safety. The specific hazards associated with the building services work and the organisational procedures for a range of health and safety related matters. They will be able to identify types of site hazards that may be encountered while at work or by members of the public also the identification of common electrical dangers encountered, and the identification of general hazards involved in the work. Bacteria from vermin can lead to Weil's disease.

9

Learners will know how to deal with commonly encountered substances. The procedures that should be followed in the case of accidents which involve injury, including requirements for the treatment of electric shock/electrical burns. Appropriate procedures which should be followed when emergency situations occur in the workplace.

The ways in which the environment may be affected by work activities: land contamination, air pollution and pollution of water courses. The current requirements and good working practices for processing waste on site. Requirements of and good working practices for recycling, dealing with hazardous waste and landfill.

10

Learners will be able to state the procedures for manual handling, the assessment of a safe load and the safe kinetic lifting technique.

The procedure that should be applied for tools and equipment that fail safety (user) checks. The methods of safe supply for electrical tools and equipment on site battery powered and 110 V and 230 V supplies. The safe isolation procedure when replacing attachments to power tools (drill bits and cutting blades).

They will be able to identify situations where it may be necessary to work at height and state how to select appropriate access equipment to permit work at heights. The safety checks to be carried

out on access equipment. Working in areas of restricted movement e.g. under suspended timber floors in roof spaces and confined spaces.

Learners will be able to identify the three elements of the fire triangle and how combustion takes place and identify the dangers of working with heat producing equipment and how to prevent fires occurring. They will know the procedures for dealing with small localised fires and firefighting equipment: tackling fires to aid escape, types of extinguisher, selection of extinguisher by fire type, the method of use and the evacuation procedures. The appropriate protective clothing and equipment that is required for identified work tasks.

11

Learners will have an awareness of the Globally Harmonised System (GHS) on the classification and labelling of hazardous substances and mixtures.

- Physical hazards: Explosives, flammable gases, oxidising liquids, corrosive to metals
- Health hazards: Acute toxicity, Skin corrosion/irritation, eye damage/irritation, Respiratory/skin sensitization.
- Environmental hazards: Hazardous to the aquatic environment
- presentation of information: GHS pictogram and signal word (Danger or Warning) and hazard statement (causes serious eye damage, toxic if swallowed, etc.) and Precautionary statement (wear eye protection, do not eat, drink or smoke when using this product, etc.).

12 - 13

Within this outcome learners will know how to use adhesives correctly. Learners will be able to state the requirements for first aid provision in the workplace. Why it is important not to misuse first aid equipment/supplies and to replace first aid supplies once used. The actions that should be taken when an accident or emergency is discovered. Identification of the procedures for dealing with minor injuries such as cuts, minor burns, objects in the eye, exposure to fumes); and major injuries such as: bone fractures, unconscious co-workers, electric shock and concussion.

They will understand the recording procedures for accidents and near misses at work
To include statutory requirements, accident books and the details to be recorded on a simple accident/incident report form.

Unit Ref: 204

Know how to install enclosures for electrical cables, conductors and wiring systems

GLH:	X
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What is this unit about?

This unit covers the **knowledge and skills** for the installation of enclosures for electrical cables, conductors and wiring systems internally and externally for electrical systems.

The learner must be able to comply with the procedures and methods for installing enclosures for electrical cables, conductors and wiring systems in accordance with the current versions of the appropriate industry standards and regulations, the specification, industry recognised working practices, the working environment and the natural environment.

They will **know** the different types of enclosures for electrical cables, conductors and wiring systems, their limitations, applications and the techniques for the positioning, fitting, fixing and connection of the enclosures, their components and accessories.

Guidance: Within this unit learners will know the main relating requirements of the IET On-Site Guide.

Knowledge and understanding:

NOS outcome:

1. The operation, applications, advantages and limitations of different electrical systems

Scope and range:

1.1 Electrical systems: circuits

Range: lighting circuits, ring final socket circuits, standard radial final socket circuits, standard circuit arrangements for loads and equipment, components of lighting and power circuits, division of an installation into circuits, polarity requirements for circuits, general requirements of isolation and switching.

1.2 Electrical systems: earthing systems and earthing and protective conductors

Range: characteristics of earthing systems: TN-S, TN-C-S and TT, protective conductors and the purpose of earthing and protective conductors when used for protection, components which provide automatic disconnection of supply (including exposed conductive parts and extraneous conductive parts), components of the earth loop impedance path, general requirements for the installation of main protective bonding.

1.3 Electrical systems: devices

Range: overcurrent and overcurrent protection: the types of and reasons for overcurrent, fuses, circuit breakers, RCDs, RCBOs, characteristics, general applications, maximum disconnection time for standard circuits. Awareness of SPDs and AFDDs.

NOS outcome:

2. The appropriate industry standards and regulations relevant to installing enclosures

Scope and range

2.1 Industry standards and regulations

Range: the requirements of the IET On-Site Guide, recognition of the main industry standards and regulations.

NOS outcome:

3. How to produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with:

- The electrical system's design
- Organisational procedures

NOS outcome:

4. How to verify that job information and documentation is current and relevant and that the plant, instruments, access equipment and tools are fit for purpose

NOS outcome:

5. The applications, advantages and limitations of types of personal protective equipment

NOS outcome:

6. The applications, advantages and limitations of types of enclosures

Scope and range:

6.1 Enclosures

Range: conduit (PVC and metallic), trunking (PVC and metallic), cable tray, cable basket, ladder- systems, ducting, modular wiring systems, busbar systems and lighting track.

NOS outcome:

7. The industry recognised methods for determining the type and size of enclosures

NOS outcome:

8. How to interpret diagrams and drawings for the electrical system to locate site services

NOS outcome:

9. How to interpret diagrams and drawings for the electrical system to identify the planned location of the enclosures

NOS outcome:

10. The methods and techniques for fitting, fixing and connecting the selected enclosures and their components and accessories in accordance with:

- The electrical system's design
- Manufacturers' instructions

Delivery advice (depth of content)

Learners will know:

1 -4

Single phase circuits:

The different circuits and wiring layouts used for lighting: the circuit diagrams for one-way, two-way, intermediate including the conversion method. The typical wiring diagrams. The joint box method, and loop in method of wiring. The block, circuit and wiring diagrams of circuits. The different components that can be used in lighting circuits including transformers, and an introduction to LED Drivers. Overcurrent protection, different switches: ways, gangs, grid switches, dimmer switches and back boxes. Cover the lighting outlets and lamps including LED. SELV Transformers, joint boxes, and RB4 and related components. Cover compatibility of dimmer switches with equipment and loads (leading and trailing edge). Bluetooth and smart wireless lighting.

The requirements of standard ring final socket circuits. Circuits for supplying sockets and connection units and fused connection units (switched and unswitched) to BS 1363. Circuit diagrams and wiring of a ring final circuit. Number of points and number of fused and unfused spurs in relation to sockets. Requirements for spurs. Way in which spurs are achieved. Floor area, division of sockets between circuits. Cover protective devices, conductor size based on cable type. Refer to the IET On-Site Guide. USB sockets.

The requirements of standard radial final socket circuits. Circuits for supplying sockets and connection units and fused connection units (switched and unswitched) to BS 1363. As above considerations see circuit types A2 and A3 in the OSG. Refer the learner to number of sockets as shown in the IET On-Site Guide. General requirements of isolation and switching that apply.

The conventional common domestic circuits such as: cooker circuit, shower circuit, immersion heater circuits (see IET OSG and requirements for immersion heater circuits). A basic appreciation of a special location (covered in the L3 unit; however, it is advantageous to expose the learner to these terms). Cover circuit and wiring diagrams of common domestic type circuits.

Why installations are divided up into circuits. See BS 7671 314: Division of Installation. Cover typical division of circuits in a dwelling. The requirements for polarity on circuits. General requirements of isolation and switching that apply. Refer to the IET On-Site Guide. Highest rated load next to the CCU switch.

Electrical systems: earthing systems and earthing and protective conductors:

The main underpinning requirements and principles as given in the IET On-Site Guide with focus principally on simple domestic dwellings and similar installations.

Electrical systems: overcurrent and overcurrent protection devices:

The main aspects of the operation, applications, advantages and limitations of fuses, circuit breakers, RCDs, RCBOs for basic single-phase circuits. The types and reasons for overcurrent: earth fault, short circuit and overload principally on simple domestic dwellings and similar installations. The common types and ratings of overcurrent protection devices. Fusing factor.

learners will know how to verify that job information and document is current and relevant such as current versions (amendments) of appropriate industry standards and regulations (BS 7671, GS 38).

The most updated version of working drawings. Refer to safe systems of work such as risk assessments and method statements.

2.

The **industry standards and regulations** and the legal status of documents used in the electrical industry. British Standards, Statutory documents, Codes of Practice, Electricity at Work Regulations, Electricity Safety, Quality and Continuity Regulations (ESQCR), The Construction (Design and Management) Regulations, BS 7671 Requirements for Electrical Installations, IET On-Site Guide, IET Guidance Notes, Best Practice guides from the Electrical Safety First. Building Regulations (Wales and England). What is meant statutory and non-statutory. The Relation of regulations to the Health and Safety at Work etc. Act. The implications of not complying with regulations, documents and Industry guidance. BASEC Approved cables.

The **industry standard documents** used for electrical installation: layout plans, technical data, specifications, site drawings, Building Regulations and Approved Documents, British/European Standards and industry guidance. How they are applied and the locational and positional requirements of wiring systems and equipment. How to interpret sources of information relevant to planning of the installation of wiring systems and equipment.

3, 4 and 5.

Note this outcome has synergy with the health and safety unit 201 (**PPE, plant, instruments, access equipment and tools**). Cover as required in the context of this unit: The purpose of PPE such as: high visibility clothing, eye protection, hand protection, head protection, foot protection, hearing protection, respiratory protection, vibration protection, and harnesses. The procedures that should be taken to remove or minimise risks before deciding PPE is needed. The appropriate protective clothing, equipment plant, instruments, access equipment and tools that is required for identified work tasks. The different types of measuring and marking out tools and equipment for wiring systems, equipment and enclosures and how to use them safely.

Job information and documentation the importance of verifying and utilising current and relevant information. Verifying issue numbers of drawings as appropriate. Using current requirements.

6.

The features, applications, advantages and limitations of different containment systems. the types of wiring systems and associated equipment used in different installations. Students will know the types of wiring systems and associated equipment used in different installations. An introduction (awareness) of the IP Code (note that the requirements for specified items of equipment is covered in unit 304).

7.

The cable capacities of conduit and trunking as given in the IET On-Site Guide. The procedure for selecting an appropriate size of conduit or trunking.

8 - 9.

The different diagrams and drawings used in electrical work. Ratios used in drawings, and conversion from site drawings to ascertain material etc. The graphical symbols used in diagrams

and drawings. Graphical symbols: switches: (one-way, two-way, intermediate, pull. Lighting points: incandescent, fluorescent, wall mounted. Socket outlets: switched, unswitched. Fused connection units switched fused connection units. Consumer control unit, cooker control unit, integrated meter (kWH meter), fuse and circuit breaker. Cover drawings which show site layout, location and component positioning. Checking that the planned locations of wiring systems are visually acceptable and compatible with other services as well as the specification. Cover the general layout and the equipment at the service position for a typical domestic installation.

10.

How to install typical wiring system containment such as: conduit (PVC and metallic), trunking (PVC and metallic), cable tray, cable basket, ladder- systems, ducting, modular wiring systems, busbar systems and power-track. The different fixing and securing methods considering the fabric of the structure, the environment, aesthetics. The methods and procedures used for the installation of wiring systems including sets and bends etc. Maximum bending radius of conduit. The importance of fire barriers and how this relates to the installation of containment. Installation complies with BS 7671, least detrimental to the environment, aesthetically pleasing.

Unit Ref:205

Know how to Install and connect electrical cables, conductors, wiring systems and equipment

GLH:	X
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What is this unit about?

This unit covers the **knowledge and skills** for the installation and connection of electrical cables, conductors, wiring systems, equipment, accessories and components for electrical systems.

The learner will be able to comply with the procedures and methods for installing and connecting electrical cables, conductors, wiring systems, equipment, accessories and components in accordance with the current versions of the appropriate industry standards and regulations, the specification, industry recognised working practices, the working environment and the natural environment.

Their **skills** will cover the different types of cables, conductors, wiring systems, equipment, accessories and components, their limitations, applications and the techniques for their positioning, fitting, fixing and connection.

The emphasis in this unit is the requirements of the IET On-Site Guide.

Knowledge and understanding:

NOS outcome:

1. The appropriate industry standards and regulations relevant to installing and connecting electrical cables, conductors, wiring systems, associated equipment, accessories and components

NOS outcome:

2. The applications, advantages and limitations of types of electrical cables, conductors, wiring systems, associated equipment, accessories and components

Scope and range:

2.1 Electrical cables

Range:

- Single and multicore thermosetting insulated cables including flexible cables
- Single and multicore thermoplastic (PVC) insulated cables including flexible cables
- PVC/PVC flat profile cable
- MICC (with and without PVC sheath)
- SWA cables (XLPE, PVC)
- Armoured/braided flexible cables
- Data cables
- Fibre optic cable
- Fire performance cable
- Support and protection methods for cables and conductors
- Cable glands
- The requirements of industrial plugs, sockets and couplers.

NOS outcome:

3. The industry recognised methods for determining the type, size and rating of electrical cables, conductors, wiring systems, associated equipment, accessories and components in relation to the electrical system's design

Scope and range:

- 3.1 Determining the **size and rating of electrical cables** (basic single-phase circuits to non-reactive loads)

Range: the basic application of diversity, determining the circuit design current, selection of a suitably rated protective device, application of rating factors: Ca, Cg, Cf, Ci, selecting a cable in accordance with the tabulated current carrying capacity, establishing and confirming the voltage drop is acceptable.

NOS outcome:

4. How to interpret diagrams and drawings for the electrical system to identify the planned location of the electrical cables, conductors, wiring systems, associated equipment, accessories and components

NOS outcome:

5. The methods and techniques for installing, fixing and connecting electrical cables, conductors, wiring systems, associated equipment, accessories and components in accordance with:

- The electrical system's design
- Manufacturers' instructions

NOS outcome:

6. The different types and methods of joining and connecting electrical cables, conductors, wiring systems

Delivery advice (depth of content)

Learners will know:

1 – 2.

Industry standards and regulations: The key requirements of BS 7671, IET On-Site Guide manufacturer's instructions for the installation and connection of cables conductors and wiring systems and equipment including relating accessories. The appropriate sources of relevant information for the termination and connection of conductors and cables in electrical wiring systems and equipment.

Cables, conductors, wiring systems: The methods and techniques of connection and termination of the range of cables given including their common applications advantages and limitations together with associated equipment, accessories and components used such as clips, cleats, saddles fixings, sleeving/identification (tags). The operating temperature limits of cables. For MICC (cover with without PVC sheath) what the sheath indicates (orange, white, Red etc.). Sizes of MICC, (e.g. what 2L1.5 means). The different types of gland used for cables e.g. for SWA: CW, BW etc. and their use.

The types of containment systems the cables are used in conjunction with and the types of installations where these wiring systems are used in domestic, commercial, industrial, agricultural/horticultural installations. Cover the common industrial plugs, sockets and couplers (BS EN 60309) for 110 V, 230 V and 415 V. Cover application of low temperature PVC insulated and sheathed cable (Arctic flex).

3.

What is meant by diversity factors and the application of IET On-Site Guide In determining the maximum demand of typical circuits after diversity has been applied.

The application of IET On-Site Guide In selecting a cable for a given application. the emphasis is on the learners to become accustomed to utilising tabulated data to select a cable for a simple single phase load taken into account the circuit design current selection of the protective device identifying and using rating factors selecting a cable and calculating and confirming voltage drop is acceptable. Learners will know the maximum voltage drop % for single circuits. Learners will be able to select an appropriate type of cable suitable for the environmental conditions and earthing arrangements (key requirements) as this will be covered further in unit 305.

4 - 5.

Diagrams and drawings: The Interpretation of use of layout and wiring diagrams, schematic diagrams, and site drawings. The use of equipment manuals/user guides.

Installing, fixing and connecting electrical cables, conductors, wiring systems, associated equipment, accessories and components: The procedures used for selecting and safely using tools and equipment for terminating cables (including eye protection). Bending radius of cables. The methods and techniques used to draw cables into conduit and trunking. The methods used to fix and support cables to buildings and structures in accordance with the key aspects of BS 7671 and the IET On-Site guide and industry practices. The use of grommets. Migration of plasticizer from PVC Cables and keeping cables clear of polystyrene granules, and wood preservatives etc. Requirements for cables in joists, wall or partition. Effects of eddy currents when cables pass through ferrous enclosures (line and neutral together, or a slot cut between). The meaning and requirements for voltage bands (Band I and Band II). Key requirements of proximity of wiring systems to other services.

6.

The advantages, disadvantages of connection methods: screw, crimped, soldered, non-screw compression, insulation displacement. The procedures for verifying that terminations and connections are electrically and mechanically sound. The consequences of terminations not being electrically and mechanically sound (Highlight the insidious nature of high resistance joints). The different types of crimps, connectors and terminals commonly used. Refer to the requirements of accessibility and electrical connections in BS 7671. Cover splicing for fibre optic.

What is this unit about?

This unit covers the **knowledge and skills of the fundamental inspections and de-energised tests required for single phase circuits.**

The learner will be able to comply with the processes and procedures for **fundamental inspections and de-energised tests** in accordance with the current versions of the appropriate industry standards and regulations, the specification and industry recognised working practices.

They will **know**, the correct methods and procedures for **fundamental inspections and de-energised tests** including the:

- identification and use of the correct instruments for **de-energised tests**
- completion of the relevant documentation
- recording of relevant data and information
- planning of the resources required to carry **de-energised tests**

Guidance: The emphasis in this unit is on the learner correctly carrying out fundamental inspections and de-energised tests on typical common circuits to include ring and radial final circuits and lighting circuits. Learners will be able to utilise test equipment, evaluate test results and record outcomes accurately. It has synergy with unit 205 in the inspection and testing of completed terminations.

Knowledge and understanding:

NOS outcome:

1. How to select the instruments to be used for carrying out relevant tests

Scope and range:

- 1.1 **Instruments** (de-energised tests on standard single-phase circuits)

Range: continuity tester, insulation resistance tester, test leads and accessories.

NOS outcome:

2. How to confirm that the test instruments are fit for purpose and have a current calibration certificate

Scope and range:

- 2.1 **Instruments** (de-energised tests on standard single-phase circuits)

Range: continuity tester, insulation resistance tester, test leads and accessories.

NOS outcome:

3. The methods and procedures for conducting a visual inspection on the enclosures for cables, conductors and wiring systems to confirm they are:

- Located and secured correctly
- Electrically and mechanically sound

Scope and range:

- 3.1 Visual inspection: main/key aspects of standard single-phase circuits.

NOS outcome:

4. The methods and procedures for conducting a visual inspection on the electrical cable, conductor and wiring systems to confirm they are:

- Located and secured correctly
- Identified and/or labelled correctly

Scope and range:

- 4.1 Visual inspection: main/key aspects of standard single-phase circuits.

NOS outcome:

5. The correct procedures for safe isolation

Scope and range:

5.1 Safe isolation

Range: reasons for safe isolation, pre-isolation considerations to others and connected equipment/circuits, the correct procedure for safe isolation.

NOS outcome:

6. The methods and processes to carry out correctly the tests that ensure safe and efficient operation of the electrical system

Scope and range:

6.1 Relevant tests (de-energised tests on standard single-phase circuits)

Range: continuity of protective bonding conductors, continuity of circuit protective conductors, continuity of ring final circuit conductors, insulation resistance, polarity.

7. Methods for providing clear and accurate information to relevant people.

Scope and range:

7.1 How to record outcomes from basic inspections and dead tests clearly and accurately.

Delivery advice (depth of content)

The learner will know:

1 - 2

How to select and safely use test instruments and accessories to carry out de-energised tests on single phase circuits. Pre-use checks, the importance of calibration. The application of GS 38.

3 – 5.

How to carry out a basic visual inspection of completed work against an installation specification and the requirements of the IET-On Site Guide (covering key common aspects). Learners will know how to carry out inspections - such as how to ensure conductors are adequately terminated, (electrically sound (low resistance, doubled over/filling the terminal) mechanically sound ('tug test'), correct cable identification. The application of the human senses during an inspection. They will know that the work should be inspected as it is being completed, and the actions to be taken where non-compliances are found.

6 - 8

How to carry out the electrical safe isolation procedure in accordance with the Electrical Safety First's Best Practice Guide No.2. The implications of electrical self-isolation to self, others and the building's electrical systems. The implications of not carrying out the safe isolation procedure. Safely isolating all forms of energy, including back-up supplies. The requirements of GS 38 for the voltage indicator.

How to carry out tests on single phase de-energised circuits. The pre-test procedure to include nulling leads and selecting the correct scale and setting for the test. They will know the reason and procedures for carrying out relevant tests and the interpretation of the results. Why test instruments, leads and accessories should be handled with care. How to record the outcomes of inspections and tests of simple circuits on relevant documentation, and why this needs to be in a clear and accurate format. The implication of carrying out IR tests which can damage sensitive loads such as dimmer switches and USB outlets in sockets. Can also charge up capacitors, (latent energy).

DRAFT

Unit Ref:208

Know electrical science and principles

GLH:	X
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What is this unit about?

This unit is about covers the fundamental knowledge of science and principles relevant to electrical work. These principles underpin the knowledge understanding and performance requirements of all units within this qualification. In relation to electrical work, learners will know the relevant fundamental mathematical principles, standard units of measurement, basic mechanics, resistance, resistivity, voltage, current and power, fundamental magnetism and electromagnetism, and supply systems.

Knowledge and Understanding

Learning outcome:

1. Know the mathematical principles which are appropriate to electrical installation work

1. The appropriate **mathematical principles** which are relevant to electrical work tasks

Range: fractions and percentages, algebra, transposition, indices and square roots.

Delivery advice (depth of content)

Learners will know:

How to utilise the fundamental mathematical principles that underpin this unit and electrical work.

How to use a The basic functions of a scientific calculator and the relevant order of operations.

How to transpose simple equations and formulas. The emphasis is on the learner having the relevant underpinning mathematical knowledge and skills to succeed in this unit and this qualification.

Knowledge and Understanding

Learning outcome:

2. Know the standard units of measurement used in electrical installation and design work

2.1 The internationally recognised base and derived (SI) units of measurement for **general quantities**

Range: length, area, volume, mass, density, time, temperature velocity.

2.2 The values of base and derived SI units which apply specifically to electrical quantities

Range: resistance, resistivity, power, frequency, current, voltage, energy.

2.3 The appropriate electrical instruments for the measurement of different **electrical quantities**

Range: resistance, power, current, voltage, energy.

Delivery advice (depth of content)

Learners will gain an appreciation of SI units of measurement for both general quantities and electrical quantities. They will be able to state units of measurement together with commonly used multiples and submultiples in electrical installation work. Learners will be able to state which instruments are required for the measurement of voltage and energy together with resistance power and current.

Knowledge and Understanding

Learning outcome:

3. Know the basic mechanics and the relationship between force, work, energy and power.

3.1 What is meant by mass and weight

3.2 The principles of basic mechanics as they apply to levers, gears and pulleys

Range: Class I, Class II and Class III

3.3 The main principles of mechanical principles and their inter-relationships

Range: force, work, energy (kinetic and potential), power, efficiency.

3.4 Calculation of mechanical energy, power and efficiency

Delivery advice (depth of content)

Learners will know the difference between mass and weight and the SI units of each. They will recognise that mass is a measure of how much matter there is in an object and weight is a measure of the pull of gravity on the object. They will understand the main principles of and basic mechanical formulas used for: force work energy power and mechanical efficiency %. Cover mechanical advantage.

Knowledge and Understanding

Learning outcome:

4. Know the relationship between resistance, resistivity, voltage, current and power.

6.1 The basic principles of electron theory

6.2 Materials which are good conductors and insulators

6.3 What is meant by resistance and resistivity in relation to electrical circuits

6.4 The relationship between current, voltage and resistance in parallel and series D.C circuits

6.5 The values of current, voltage and resistance in parallel and series D.C circuits

6.6 The values of power in parallel and series D.C circuits

6.7 What is meant by the term voltage drop in relation to electrical circuits

6.8 The chemical and thermal effects of electric currents

Delivery advice (depth of content)

Learners will gain an appreciation of the fundamental theory of electrical circuits and will be able to calculate resistance and resistivity with the resistivity values of common conductors used for electrical installation.

They will be able to carry out calculations for voltage current and resistance for resistors in series and parallel circuits and combined combinations. they will be able to calculate power dissipated at loads series and parallel circuits and combined combinations understand voltage drop in relation to electrical circuits. they will know the chemical and thermal effects of electric currents.

Knowledge and Understanding

Learning outcome:

5. Know the fundamental principles which underpin the relationship between magnetism, electricity, generation, and supply systems.

5.1 The effects of magnetism in terms of attraction and repulsion

5.2 The difference between magnetic flux and flux density

5.3 The magnetic effects of electrical currents in terms of:

- Production of a magnetic field
- Force on a current-carrying conductor in a magnetic field
- Electromagnetism
- Electromotive force.

5.4 The basic principles of A.C generation in terms of:

- A single-loop generator
- Sinewave
- Frequency
- EMF
- Magnetic flux
- Three-phase systems.

5.5 The characteristics of **sinewaves**

Range: root mean square (rms) value, average value, peak to peak value, periodic time, frequency, amplitude.

5.6 The features and characteristics of a **generation, transmission, and distribution system.**

Range: Power stations, fossil fuels, hydro, nuclear, super-grid and standard grid system, transformers, transmission voltages, distribution voltages, sub-stations, above and below ground distribution.

Delivery advice (depth of content)

Learners will know:

Learners will gain an appreciation magnetism and electromagnetism. They will be able to identify how a sine wave is generated and the features and characteristics of sine waves together with determining relevant A.C values: root mean square (rms) value, average value, peak to peak value, periodic time, frequency, amplitude.

Learners will know how electricity is generated, transmitted, and distributed to consumers. The transmission and distribution voltages to different types of consumer and basic power loss. They will understand the main characteristics of electrical supplies. The reasons for using alternating current transmission and distribution. The reasons for the neutral conductor. The advantages of distributing loads evenly over the three lines.

DRAFT

What is this unit about?

This unit is about covers the skills required to carry out electrical work. It will enable the learner to practice and be assessed on a range of electrical work at the safely at the centre. The content reflects the NOS to facilitate the learner's progression into an apprenticeship.

Inherent within this unit is the knowledge and understanding of the principles that guide the work of practice in this trade area, trade-specific terminology, the requirements for performing a wide range of tasks in this trade area, including in the construction and maintenance stages, how to read and interpret plans and documentation required in performing a wide range of tasks in this trade area, how to evaluate the performance of carrying out a wide range of tasks in this trade area both in relation to the set requirements and their own success criteria.

The enables learners to:

- carry out a wide range of tasks in this trade area,
- perform a wide range of tasks in ways that promote their own health and safety and that of others,
- read and interpret plans and documentation required in performing a wide range of tasks in this trade area,
- plan the completion of a wide range of tasks in this trade area, using the required literacy and numeracy skills,
- set performance criteria for their completion of a wide range of tasks in this trade area,
- evaluate the performance of their work in carrying out a wide range of tasks in this trade area both in relation to the set requirements and their own success criteria.

PERFORMANCE CRITERIA TO BE ADDED