

Level 3 Diploma in Electrical Installations (Buildings and Structures) (2365-03)



January 2018 Version 1.6



Qualification at a glance

Subject area	Electrotechnical
City & Guilds number	2365-03
Entry requirements	Level 2
Assessment	By online test/assignment
Fast track	Available
Support materials	Qualification handbook Assignment guides Text Book available June 2013 Smartscreen available February 2013
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Level 3 Diploma in Electrical Installation (Buildings and Structures)	2365-03	600/5499/2

Version and date	Change detail	Section
1.1 Aug 2012	Correction of Assessment information	Assessment
1.2 Sept 2012	Amended information on where to obtain assessments. Added unit aim to unit 301. Amended the roles and opportunities for progression sections in the range for learning outcome one for unit 308.	Assessment Units
1.3 March 2013	Unit 301- LO4 - AC4.2 – amended typing error – now reads ‘identify typical disadvantages’	Units
1.4 July 2017	Review and update to the following units and assessments 201, 302,303, 304 and 305	Units and Assessments
1.5 October 2017	Test specification for test 623 completed. Test duration for test 623, 624 and 625 amended Range added to unit 201, LO4.	Units and Assessments
1.6 January 2018	Greater clarity on permitted materials and pass mark added for unit 301	Test specifications



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1 Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	For candidates who want to work as electricians in the building services engineering sector. This qualification does not make candidates fully qualified electricians (see Appendix 2).
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the electrotechnology sector. See Appendix 2 for further information.
What opportunities for progression are there?	It allows candidates to progress into employment, although not as a fully qualified electrician, or to the following City & Guilds qualifications: <ul style="list-style-type: none">• Level 3 NVQ in Electrotechnical Services• Level 3 Diploma in Electrotechnical Technology• Level 3 Award in the Initial Verification and Certification of Electrical Installations• Level 3 Award in the Periodic Inspection, Testing and Certification of Electrical Installations• Level 4 Award in Design and Verification of Electrical Installations

Structure

To achieve the **Level 3 Diploma in Electrical Installation (Buildings and Structures)**, learners must achieve **52** credits from the mandatory units.

Unit accreditation number	City & Guilds unit number	Unit title	Credit value	Level	GLH
Mandatory					
T/503/9669	201	Health and safety in building services engineering	3	2	26
K/602/3138	301	Understand the fundamental principles and requirements of environmental technology systems	2	3	15
A/503/9950	302	Principles of electrical science	12	3	111
F/503/9951	303	Electrical installations: fault diagnosis and rectification	9	3	84
R/503/9954	304	Electrical Installations: inspection, testing and commissioning	12	3	110
K/503/9958	305	Electrical systems design	12	3	114
K/504/0253	308	Career awareness in building services engineering	2	3	20



2 Centre requirements

Approval

Centres already offering City & Guilds qualifications

If your Centre is approved to offer the **2330 Certificate in Electrotechnical Technology** you can apply for the new **Level 3 Diploma in Electrical Installations (Buildings and Structures) (2365-03)** approval using the **fast track approval form**, available from the City & Guilds website.

Centres should use the fast track form if:

- there have been no changes to the way the qualifications are delivered, and
- they meet all of the approval criteria in the fast track form guidance notes.

Fast track approval is available for 12 months from the launch of the qualification. After 12 months, the Centre will have to go through the standard Qualification Approval Process. The centre is responsible for checking that fast track approval is still current at the time of application.

Centres NOT already offering City & Guilds qualifications

To offer this qualification, new centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual – Supporting Customer Excellence* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification[s] before designing a course programme.

Resource requirements

Physical resources and site agreements

Centres can use specially designated areas within a centre to assess the simulated practical assignments. The equipment, systems and machinery must meet industrial standards and be capable of being used under normal working conditions.

Human Resources

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be technically competent in the area(s) for which they are delivering training and/or have experience of providing training
- hold appropriate qualifications detailed in this handbook

- have recent relevant experience in the specific area they are assessing
- be able to demonstrate occupational competence in the areas of the Building Services Engineering (BSE) for which they are delivering training and/or assessment. This competence must be at a level equal to, or above, the level of training being delivered and must include current knowledge and skills of each industry (for which the assessment is taking place), its techniques, settings, legislative and regulatory requirements, codes of practice and guidance
- have credible experience of providing training and/or assessment.

Centre staff may undertake more than one role, eg tutor and assessor or internal quality assurer, but must never verify their own assessments.

Assessors must;

- hold, or be working towards TAQA (A1/A2 – D32/33 updated) standards and continue to practice to these standards and possess CPD evidence of personally maintaining these standards, or
- have other suitable equivalent assessor qualifications endorsed by the Sector Skills Council and/or the Awarding Organisation.

Assessor Occupational Competence

For the purposes of this qualification, occupational competence will be deemed to have been demonstrated by the verifiable evidence of **one, preferably more**, of the following:

- **a relevant sector** qualification equal to or at a level above the training and/or assessment being delivered. Where earlier forerunner qualifications are held eg City and Guilds Craft or Advanced Craft Certificated, the assessor must demonstrate through CPD evidence a thorough knowledge of the qualification standards that they meet the required criteria
- **an up-to-date CPD record including relevant CPD qualifications.** Assessors must either be able to demonstrate that they are registered and up-to-date with their registration with an appropriate approved industry registration body or have one or more relevant occupational qualifications to demonstrate that they can be regarded as occupationally competent in terms of assessing or verifying the qualification and the unit contained
- **a verifiable CV** of industry experience and current knowledge of industry practice and techniques relevant to the occupational area in which they assess. This verifiable evidence must be **at or above the level being assessed**
- a thorough **knowledge and understanding** of the qualification standards and requirements

Assessor continuing professional development (CPD)

The occupational competence of assessors must be updated on a regular basis and be periodically reconfirmed via CPD evidence and quality assured by City and Guilds.

It is the responsibility of the assessor to make use of opportunities for CPD such as industry conferences and events, access to trade publications and journals, SSC and professional/Trade Association events, at least on an annual basis to enhance and upgrade their professional development and technical knowledge.

It is imperative that evidence records of these CPD opportunities/occasions are maintained and retained in a verifiable CPD record.

Guidance note

Where questions arise about the occupational competence/qualification of an individual/trainer/assessor, these should be referred to the centre's Qualifications Adviser for a decision. The Qualification Adviser may decide to refer the decision to the Portfolio/Group Portfolio Consultant for further consideration.

Candidate entry requirements

Candidates should already hold the Level 2 Diploma in Electrical Installations (Buildings and Structures) (2365-02) or equivalent in order to complete the qualification satisfactorily.

Without evidence of formal qualifications, candidates must demonstrate adequate prior knowledge and experience to ensure they have the potential to gain the qualification.

Age restrictions

This qualification is approved for learners 16+.

Accreditation of prior learning (APL)

Guidance on APL between this qualification and the 2357 qualification will be available on the website by the start of November 2012.



3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs,
- support and guidance they may need when working towards their qualification[s].
- any units they have already completed, or credit they have accumulated which are relevant to the qualification[s].
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Induction should also be used to ensure that candidates are aware that this qualification does **not** make them qualified electricians. **All candidates must complete a declaration confirming their understanding. This declaration can be found in Appendix 2.**

Support materials

The following resources are available for this qualification:

Description	How to access
Assignment guides	City & Guilds website
Text Book	Available June 2013
Smartscreen	Available February 2013



4 Assessment

Assessment of the qualification

Unit no.	Unit Title	Assessment method	Where to obtain assessment materials
201	Health and safety in building services engineering	Practical Assignment (211) Externally set assignment, locally marked and externally verified City & Guilds on-line multiple choice test (601) These assessments cover the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit.	Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden. On-line test available for booking on the Walled Garden.
301	Understand the fundamental principles and requirements of environmental technology systems	City & Guilds on-line multiple choice test (301) The assessment covers the knowledge requirements of the unit and assesses all learning outcomes to verify coverage of the unit.	On-line test available for booking on the Walled Garden.
302	Principles of Electrical Science	Written Assignment (612) Externally set assignment, locally marked and externally verified The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit.	Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden.

303	Electrical installations: fault diagnosis and rectification	<p>Practical Assignment (613)</p> <p>Externally set assignment, locally marked and externally verified. City & Guilds on-line multiple choice test (623)</p> <p>These assessments cover the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit.</p>	<p>Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden.</p> <p>On-line test available for booking on the Walled Garden.</p>
304	Electrical Installations: Inspection, Testing and Commissioning	<p>Practical Assignment (614)</p> <p>Externally set assignment, locally marked and externally verified</p> <p>City & Guilds on-line multiple choice test (624)</p> <p>These assessments cover the knowledge and practical requirements of the unit and assess all learning outcomes to verify coverage of the unit.</p>	<p>Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden.</p> <p>On-line test available for booking on the Walled Garden.</p>
305	Electrical Systems Design	<p>Practical Assignment (615)</p> <p>Externally set assignment, locally marked and externally verified</p> <p>City & Guilds on-line multiple choice test (625)</p> <p>These assessments cover the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit.</p>	<p>Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden.</p> <p>On-line test available for booking on the Walled Garden.</p>
308	Career awareness in building services engineering	<p>Practical Assignment (308)</p> <p>Externally set assignment, locally marked and externally verified</p> <p>The assessment covers the knowledge and practical requirements of the unit and assesses all learning outcomes to verify coverage of the unit.</p>	<p>Go to www.cityandguilds.com and navigate to the 2365 webpage. Password available on the Walled Garden.</p>

Test Specifications

Test: 601 Health and safety in building services engineering

Assessment method: e-volve online multiple choice test

Duration: 40 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book and non-programmable calculator

Outcome	Number of questions	%
01 Understand how relevant legislation applies in the work place	4	16
02 Understand the procedures for dealing with Environmental and Health and Safety situations in the work environment	6	24
03 Understand the procedures for establishing a safe working environment	7	28
04 Understand the requirements for identifying and dealing with hazards in the work environment	8	32
Total	25	100

Test: 301 Understand the fundamental principles and requirements of environmental technology systems

Assessment method: e-volve online multiple choice test

Duration: 75 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book and non-programmable calculator

Outcome	Number of questions	%
01 Know the fundamental working principles of micro-renewable energy and water conservation technologies	10	37
02 Know the fundamental requirements of building location/building features for the potential to install micro-renewable and water conservation systems to exist	9	33
03 Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies	4	15
04 Know the typical advantages and disadvantages of micro-renewable energy and water conservation technologies	4	15
Total	27	100

Test: 612 Principles of Electrical Science

Assessment method: Written Assignment

Duration: 120 minutes

Grade boundaries: Will be approximately

Pass: 50%

Merit: 65%

Distinction: 80%

*Although candidates are able to achieve a merit or a distinction within this individual unit, this can only be reflected as a pass within this diploma. However, the merit or distinction grade can be carried over to the 5357-03 equivalent unit Electrical Scientific Principles and Technologies.

Permitted materials: Closed book and non-programmable calculator

Outcome	Number of questions	%
01 Understand electrical supply systems	6	23
02 Understand how different electrical properties can affect electrical circuits, systems and equipment	8	31
03 Understand the operating principles and applications of DC machines and AC motors	4	15
04 Understand the operating principles of electrical components	3	11
05 Understand the principles and applications of electrical lighting systems	3	11
06 Understand the principles and applications of electrical heating	2	8
Total	26	100

Test: 623 Electrical Installations: Fault Diagnosis and Rectification

Assessment method: e-volve online multiple choice test

Duration: 60 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book and non-programmable calculator

Outcome	Number of questions	%
01 Understand the health and safety requirements relevant to fault diagnosis	3	10
02 Understand the importance of reporting and communication in fault diagnosis	2	7
03 Understand the nature and characteristics of electrical faults	6	20
04 Understand the fault diagnosis procedure	10	33
05 Understand the procedures and techniques for correcting electrical faults	9	30
Total	30	100

Test: 624 Electrical Installations: Inspection, Testing and Commissioning

Assessment method: e-volve online multiple choice test

Duration: 80 minutes

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book and non-programmable calculator

Outcome	Number of questions	%
01 Understand the requirements for completing the safe isolation of electrical circuits and installations	6	17
02 Understand the requirements for initial verification of electrical installations	2	6
03 Understand the requirements for completing the inspection of electrical installations prior to their being placed into service	Assessed by assignment	
04 Understand the requirements for the safe testing and commissioning of electrical installations	8	23
05 Understand the requirements for testing before circuits are energised	7	20
06 Understand the requirements for testing energised installations	10	28
07 Understand the requirements for the completion of electrical installation certificates and associated documentation	2	6
Total	35	100

Test: 625 Electrical Systems design

Assessment method: e-volve online multiple choice test

Duration: 70 minutes

Grade boundaries: Pass is approximately 70%

Permitted materials: IET on-site guide and non-programmable calculator

Outcome	Number of questions	%
1 Understand how to prepare for the installation of wiring systems	5	17
2 Understand the applications of wiring systems	9	30
3 Understand the practices and procedures for carrying out electrical work	8	26
6 Understand protection against overcurrent	5	17
7 Understand electrical systems and circuits	3	10
Total	30	100



Units

Availability of units

The following units can also be obtained from The Register of Regulated Qualifications: <http://register.ofqual.gov.uk/Unit>

Structure of units

These units each have the following:

- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- unit aim
- health and safety requirements
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance, where applicable.

Unit 201

Health and safety in building services engineering

UAN:	T/503/9669
Level:	Level 2
Credit value:	3
GLH:	26
Aim:	This combination unit provides learners with the essential health and safety knowledge and skills to demonstrate best practice in a business services engineering environment or sector. The unit provides learners with an awareness of relevant legislation and should underpin all business services engineering activities learners take part in.
Health and safety:	Health and safety behaviour learned in this mandatory unit should be displayed in all arenas.

Learning outcome
The learner will: 1. Understand how relevant legislation applies in the workplace
Assessment criteria
The learner can: 1. identify roles and responsibilities with regard to current relevant Health and Safety legislation 2. identify roles and responsibilities with regard to current relevant environmental legislation

Range
Roles: <ul style="list-style-type: none">• Employers• Employees• Organisations• Clients.
Relevant Health and Safety legislation: <ul style="list-style-type: none">• The Health and Safety at Work 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.

Relevant Environmental legislation:

- 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.

Learning outcome

The learner will:

2. Understand the procedures for dealing with Environmental and Health and Safety situations in the work environment

Assessment criteria

The learner can:

1. state the procedures that should be followed in the case of accidents which involve injury, including requirements for the treatment of electric shock/electrical burns
2. specify **appropriate procedures** which should be followed when emergency situations occur in the workplace
3. state the actions to be taken in situations which exceed their level of responsibility for Health and Safety in the workplace
4. specify **appropriate responsible persons** to whom Health and Safety and welfare related matters should be reported.
5. describe the **ways in which the environment may be affected by work activities**
6. specify the current **requirements and good working practices** for processing waste on site
7. explain why it is important to report any hazards to the environment that arise from work procedures

Range

Appropriate procedures:

- Procedures for summoning emergency services
- Information that emergency services require
- Alarm and evacuation procedures
- Designated escape routes
- Fire fighting procedures
- Application of first aid
- RIDDOR reporting procedure.

Appropriate responsible persons:

- Employer
- Employees
- Customer/client

- Safety officers
- Health & Safety executive/inspectors
- Trades union representative
- Environmental health officers

Effect of work activities:

- Land contamination
- Air pollution
- Pollution of water courses.

Requirements and good working practices:

- Recycling
- Hazardous waste
- Landfill.

Learning outcome

The learner will:

3. Be able to demonstrate and understand the procedures for establishing a safe working environment

Assessment criteria

The learner can:

1. state the procedure for producing risk assessments and method statements in accordance with their level of responsibility
2. describe the procedures that should be taken to remove or minimise risks before deciding PPE is needed
3. state the purpose of PPE
4. specify the appropriate protective clothing and equipment that is required for identified work tasks
5. state the first aid facilities that must be available in the work area in accordance with Health and Safety regulations
6. explain why it is important not to misuse first aid equipment/supplies and to replace first aid supplies once used
7. describe and demonstrate safe practices and **procedures** for the use of **equipment and materials** in the working environment
8. specify and demonstrate the procedures for ensuring electrical systems are safe to work on
9. state the **implications** of:
 - a. carrying out safe isolation procedures
 - b. not carrying out safe isolation procedures.

Range

Procedures:

- Responsible persons
- Competent persons
- Safe isolation procedures
- Permits to work
- Selection and checking correct power tools, hand tools or portable electrical equipment.

<p>Equipment and materials:</p> <ul style="list-style-type: none"> • Access equipment (PASMA requirements) • Portable power tools (eg cartridge gun, drills, grinders) • Tools and materials storage facilities • Dangerous substances (eg cutting compounds and adhesives) • Ladders • Use of mobile scaffold towers • Use of signs and guarding. <p>Implications:</p> <ul style="list-style-type: none"> • Self • Others • Building systems.
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<p>Learning outcome</p> <p>The learner will:</p> <p>4. Understand the requirements for identifying and dealing with hazards in the work environment</p>
<p>Assessment criteria</p> <p>The learner can:</p> <ol style="list-style-type: none"> 1. identify warning signs for the seven main groups of hazardous substance, as defined by The Chemical (Hazard Information and Packaging for Supply) Regulations (CHIP) 2. define what is meant by the term hazard in relation to Health and Safety legislation in the workplace 3. identify specific hazards associated with the installation and maintenance of electrical systems and equipment 4. describe situations which can constitute a hazard in the workplace 5. explain practices and procedures for addressing hazards in the work place (inferred through practical) 6. identify the correct type of fire extinguisher for a particular type of fire 7. explain situations where asbestos may be encountered 8. specify the procedures for dealing with the suspected presence of asbestos in the workplace

<p>Range</p> <p>Specific hazards:</p> <ul style="list-style-type: none"> • Electric shock (direct and indirect contact) • Burns • Fires • Explosions. <p>Situations:</p> <ul style="list-style-type: none"> • Temporary electrical supplies • Trailing leads/cables • Slippery or uneven surfaces • 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.
- Hazards in the workplace:**
- Temporary electrical supplies
 - Trailing leads/cables
 - Slippery or uneven surfaces
 - Presence of dust and fumes
 - Handling and transporting equipment or materials
 - Contaminants and irritants
 - Fire
 - Working at height
 - Hazardous malfunctions of equipment
 - Improper use and storage of tools and equipment
 - Bacteria: Weil's disease
 - Use of signs to warn of hazards.
- Where asbestos may be encountered:**
- In decorative finishes (aertex, plaster, floor tiles)
 - In accessories (flash guards and matting in fuse carriers and on distribution board covers)
 - In insulation storage compartments, vessels and pipework.

Notes for guidance

In the delivery of this unit emphasis shall be made to the learner on the necessity to keep up to date with the latest standards, technologies and practices which relate to and affect the topics covered in this unit. This is then in keeping with good engineering practice.

Unit 201 Health and safety in building services engineering

Supporting information

Guidance

Electrical equipment

Includes power tools, lights etc

Safe Isolation Procedure

Recommend referring to JIB Safe Isolation Procedure

On Site

Where reference to 'on site' is made in this unit, the intention is that this covers building sites and domestic sites.

It is recommended that assessors cover employee rights in relation to Health & Safety.

This First Aid element of this unit is not intended to replicate a full First Aid course but to give learners the underpinning knowledge to understand the types of injuries they may come across in a work place.

Unit 301

Understand the fundamental principles and requirements of environmental technology systems

UAN:	K/602/3138
Level:	Level 3
Credit value:	2
GLH:	15
Aim:	This knowledge unit provides learning in the fundamental working principles along with regulatory requirement relating to renewable energy. Be able to distinguish the potential type of building features that will meet the requirements to install renewable energy water conservation along with typical advantages and disadvantages.
Health and safety	Healthy and safety behaviour learned in mandatory unit 201 should be displayed in all arenas.

Learning outcome
The learner will: 1. Know the fundamental working principles of micro-renewable energy and water conservation technologies
Assessment criteria
The learner can: 1.1 Identify the fundamental working principles for each of the following <ul style="list-style-type: none">• heat producing micro-renewable energy technologies:• solar thermal (hot water)• ground source heat pump• air source heat pump• biomass 1.2 Identify the fundamental working principles for each of the following electricity producing micro-renewable energy technologies: <ul style="list-style-type: none">• solar photovoltaic• micro-wind• micro-hydro 1.3 Identify the fundamental working principles of the following co-generation technologies: <ul style="list-style-type: none">• micro-combined heat and power (heat-led) 1.4 Identify the fundamental working principles for each of the following water conservation technologies: <ul style="list-style-type: none">• rainwater harvesting• greywater re-use.

Learning outcome
The learner will: 2. Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist
Assessment criteria
The learner can: 2.1 Clarify the fundamental requirements for the potential to install a solar water heating system to exist 2.2 Clarify the fundamental requirements for the potential to install a solar photovoltaic system to exist 2.3 Clarify the fundamental requirements for the potential to install a ground source heat pump system to exist 2.4 Clarify the fundamental requirements for the potential to install an air source heat pump system to exist 2.5 Clarify the fundamental requirements for the potential to install a biomass system to exist 2.6 Clarify the fundamental requirements for the potential to install a micro wind system to exist 2.7 Clarify the fundamental requirements for the potential to install a micro hydro system to exist 2.8 Clarify the fundamental requirements for the potential to install a micro-combined heat and power (heat led) system to exist 2.9 Clarify the fundamental requirements for the potential to install a rain water harvesting/greywater re-use system to exist.

Learning outcome
The learner will: 3. Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies
Assessment criteria
The learner can: 3.1 Confirm what would be typically classified as ‘permitted development’ under town and country planning (environmental impact) regulations in relation to the deployment of the following technologies: <ul style="list-style-type: none"> • solar thermal (hot water) • solar photovoltaic • ground source heat pump • air source heat pump • micro-wind • biomass • micro-hydro • micro-combined heat and power (heat-led) • rainwater harvesting • greywater re-use 3.2 Confirm which sections of the current building regulations/building standards apply in relation to the deployment of the following

technologies:

- solar thermal (hot water)
- solar photovoltaic
- ground source heat pump
- air source heat pump
- micro-wind
- biomass
- micro-hydro
- micro-combined heat and power (heat-led)
- rainwater harvesting
- greywater re-use.

Learning outcome

The learner will:

4. Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies

Assessment criteria

The learner can:

- 4.1 Identify typical advantages associated with each of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power (heat-led)
 - rainwater harvesting
 - greywater re-use
- 4.2 Identify typical disadvantages associated with each of the following technologies:
 - solar thermal (hot water)
 - solar photovoltaic
 - ground source heat pump
 - air source heat pump
 - micro-wind
 - biomass
 - micro-hydro
 - micro-combined heat and power (heat-led)
 - rainwater harvesting
 - greywater re-use.

UAN:	A/503/9950
Level:	Level 3
Credit value:	12
GLH:	111
Aim:	The aim of this unit is to enable the candidate to understand the principles of electrical science related to AC theory, machines, devices and systems. This understanding is applied when designing wiring systems for clients and fault diagnosis.
Health and safety:	Health and safety behaviour learned in mandatory unit 201 should be displayed in all arenas.

Learning outcome
The learner will: 1 Understand electrical supply systems
Assessment criteria
The learner can: 1. describe how electricity is generated and transmitted for domestic and industrial/commercial consumption 2. specify the features and characteristics of a generation and transmission system 3. state the basic operating principles of other sources of electricity 4. describe the main characteristics of: a. single phase electrical supplies b. three phase electrical supplies c. three phase and neutral supplies d. sub-station transformers. 5. identify types of transformers 6. describe the operating principles, applications and limitations of transformers 7. determine by calculation and measurement: a. primary and secondary voltages b. primary and secondary current c. kVA rating of a transformer.

Range
Features and characteristics: <ul style="list-style-type: none"> • Power Stations • Fossil fuels

<ul style="list-style-type: none"> • Hydro • Nuclear • Super-grid and standard grid system • Transformers • Transmission voltages • Distribution voltages • Sub-stations • Above and below ground distribution. <p>Other sources:</p> <ul style="list-style-type: none"> • Batteries, cells or UPS systems • Solar power (thermal and photovoltaic) • Wind energy • Wave energy • Micro hydro • Combined Heat and Power (CHP) including micro CHP. <p>Operating principles, applications and limitations:</p> <ul style="list-style-type: none"> • Iron loss • Copper loss • Relationship between current and voltage • Primary and secondary windings • Step up and step down transformers.

Learning outcome
<p>The learner will:</p> <p>2 Understand how different electrical properties can affect electrical circuits, systems and equipment</p>
Assessment criteria
<p>The learner can:</p> <ol style="list-style-type: none"> 1. explain the relationship between resistance, inductance, capacitance and impedance 2. determine electrical quantities in alternating current circuits 3. explain the relationship between kW, kVAr, kVA and power factor 4. calculate power factor 5. explain what is meant by power factor correction 6. specify methods of power factor correction 7. determine the neutral current in a three-phase and neutral supply and why systems should be balanced 8. calculate values of voltage and current in star and delta connected systems

Range
<p>Electrical quantities:</p> <ul style="list-style-type: none"> • Resistance • Inductance • Inductive reactance • Capacitance • Capacitive reactance

- Impedance.

Learning outcome

The learner will:

3 Understand the operating principles and applications of DC machines and AC motors

Assessment criteria

The learner can:

1. state the basic types, applications and describe the operating principles of **DC machines**
2. describe the operating principles of **AC motors**
3. state the basic types, applications and limitations of **AC motors**
4. describe the basic operating principles, limitations and applications of **motor control**

Range**DC machines:**

- Series
- Shunt
- Compound.

AC motors:

- single phase AC motors (induction, capacitor start, split phase, universal, synchronous)
- three phase AC motors (induction; wound-rotor).

Motor control:

- Direct-on-line
- Star-Delta
- Rotor-resistance
- Soft-start
- Variable frequency.

Learning outcome

The learner will:

4 Understand the operating principles of electrical components

Assessment criteria

The learner can:

1. specify the main types and operating principles of **electrical components**

Range**Electrical components:**

- Contactors
- Relays

- Solenoids
- Over-current protection devices:
 - Fuses (HRC, cartridge and re-wireable)
 - Circuit-breakers
 - RCBOs.
- RCDs.

Learning outcome
The learner will: 5. Understand the principles and applications of electrical lighting systems
Assessment criteria
The learner can: 1. explain the basic principles of illumination and state the applications of: <ul style="list-style-type: none"> a. inverse square law b. cosine law c. lumen method. 2. explain the operating principles, types, limitations and applications of luminaires

Range
Luminaires: <ul style="list-style-type: none"> • General Lighting Service (GLS): <ul style="list-style-type: none"> ○ Tungsten ○ Halogen. • Discharge lighting: <ul style="list-style-type: none"> ○ Low and high pressure mercury vapour ○ Low and high pressure sodium vapour ○ Metal halide. • Energy saving (such as compact fluorescent lamps) • LED.

Learning outcome
The learner will: 6. Understand the principles and applications of electrical heating
Assessment criteria
The learner can: 1. explain the basic principles of electrical space heating and electrical water heating 2. explain the operating principles, types, limitations and applications of electrical space and water heating appliances and components

Unit 303

Electrical installations: fault diagnosis and rectification

UAN:	F/503/9951
Level:	Level 3
Credit value:	9
GLH:	84
Aim:	The unit is designed to enable learners to understand how to carry out fault diagnosis and rectification of complex electrical systems safely and in accordance with regulatory requirements, with an emphasis on period inspection scenarios. Learners will also develop the skills to apply their understanding of fault diagnosis in simulated environments
Health and safety:	Health and safety behaviour learned in mandatory unit 201 should be displayed in all arenas.

Learning outcome
The learner will: <ol style="list-style-type: none">1. Understand the Health and Safety requirements relevant to fault diagnosis
Assessment criteria
The learner can: <ol style="list-style-type: none">1. state the dangers of electricity in relation to fault diagnosis work2. identify the Health and Safety requirements relevant to diagnosing and correcting electrical faults in electrical systems and equipment3. specify safe working procedures that should be adopted for completion of fault diagnosis and correction work.

Range
<p>Health and Safety requirements</p> <ul style="list-style-type: none"> • Working in accordance with risk assessments / permits to work/method statements • Safe use of tools and equipment • Safe and correct use of measuring instruments • Provision and use of PPE • Reporting of unsafe situations
<p>Safe working procedures</p> <ul style="list-style-type: none"> • Effective communication with others, i.e. people on the premises, customers etc. • Use of barriers • Positioning of notices • Safe isolation • Use of equipment to GS 38

Learning outcome
<p>The learner will:</p> <ol style="list-style-type: none"> 2. Understand the importance of reporting and communication in fault diagnosis
Assessment criteria
<p>The learner can:</p> <ol style="list-style-type: none"> 1. describe the documentation relevant to fault diagnosis 2. state the implications of the fault diagnosis for customers and clients 3. explain the communication requirements relevant to fault diagnosis

Range
<p>Implications</p> <ul style="list-style-type: none"> • Loss of circuits • Equipment
<p>Communication requirements</p> <ul style="list-style-type: none"> • Informing relevant persons about information on electrical fault diagnosis and correction work • Why it is important to provide relevant persons with information on fault diagnosis and correction work clearly, courteously and accurately • Explain why relevant people need to be kept informed during completion of fault correction work: <ul style="list-style-type: none"> ○ Other workers/colleagues ○ Customers/clients ○ Representatives of other services

Learning outcome
The learner will: 3. Understand the nature and characteristics of electrical faults
Assessment criteria
The learner can: 1. identify types, causes and consequences of electrical faults 2. describe typical types of faults and their likely locations in wiring systems and equipment.

Range
<p>Electrical faults</p> <ul style="list-style-type: none"> • Loss of supply • Low voltage/voltage drop • Component/equipment malfunction/failure • Operation of overload or fault current devices • Arcing - loose connection • High resistance - loose connection • Transient voltages - lighting strike • Excess current - overload • Insulation failure - deterioration, mechanical damage <ul style="list-style-type: none"> ◦ Short-circuit ◦ Open Circuit ◦ Earth fault • Signal faults. <p>Locations in wiring systems</p> <ul style="list-style-type: none"> • Wiring Systems • Terminations and connections • Equipment/accessories (switches, luminaires, switchgear and control equipment) • Instrumentation/metering.

Learning outcome
The learner will: 4. Understand the fault diagnosis procedure
Assessment criteria
The learner can: 1. state precautions that must be taken when carrying out fault diagnosis with regard to particular locations, equipment and circumstances 2. explain the logical stages of fault diagnosis. 3. select the appropriate test instrument/s for fault diagnosis work 4. describe how test instruments are confirmed to be fit for purpose and functioning correctly 5. specify an appropriate and logical procedures for carrying out fault diagnosis tests 6. analyse and determine if test results are acceptable

Range

Particular locations, equipment and circumstances:

- Lone working
- Hazardous areas
- Fibre-optic cabling
- Electro-static discharge (friction, induction, separation)
- Electronic devices (damage by over voltage)
- IT equipment (eg. shutdown, damage)
- High frequency or capacitive circuits
- Presence of batteries (eg. lead acid cells, connecting cells)
- Additional sources of energy
- Time controlled devices.

Logical stages:

- Identification of symptoms
- Collection and analysis of data
- Use of sources/types of information such as BS 7671, Certificates/Reports, Installation Specifications, drawings/diagrams, manufacturer's information and operating instructions
- Maintenance records
- Experience (personal and of others) i.e. speaking to operators/customers to determine nature/characteristics of the fault
- Checking and testing (eg. supply, protective devices)
- Interpreting results/information
- Fault correction
- Functional testing
- Restoration
- Test equipment in accordance with HSE guidance document GS 38.

Test instrument/s:

- Voltage indicator
- Low resistance ohm meter
- Insulation resistance testers
- EFLI and PFC tester
- RCD tester
- Tong tester/clamp on ammeter
- Phase sequence tester
- Dead testing
- Live testing.

Tests:

- Continuity
- Insulation resistance
- Polarity
- Earth fault loop impedance
- RCD operation
- Current and voltage measurement
- Phase sequence
- Functional testing/checking.

Learning outcome
The learner will: 5. Understand the procedures and techniques for correcting electrical faults
Assessment criteria
The learner can: 1. identify factors which can affect repair or replacement of equipment 2. specify the procedures for verifying that the fault has been corrected suitably for the situation using technical analysis. 3. state the methods to ensure the safe disposal of any waste and that the work area is left in a safe and clean condition

Range
<p>Factors:</p> <ul style="list-style-type: none"> • Cost • Availability of replacement parts, resources and staff • Down time (planning) • Legal and personal responsibility (eg. contracts, warranties, relevant personnel) • Access to systems and equipment • Provision of emergency or stand by supplies • Client demand (continuous supply, out of hours working). <p>Verifying:</p> <ul style="list-style-type: none"> • Functional testing/checking • Continuity • Insulation resistance • Polarity • Earth fault loop impedance • RCD operation • Current and voltage measurement/ checking presence of supply • Phase sequencing.

Learning outcome
The learner will: 6. Perform fault diagnosis
Assessment criteria
The learner can: 1. follow safe working procedures 2. evaluate and apply appropriate fault diagnosis methods and techniques 3. diagnose electrical faults using engineering decision and evaluation of symptoms and findings 4. recommend the appropriate action/s to correct the fault

Range**Methods:**

- Logical stages of fault diagnosis
- Identification of symptoms
- Collection and analysis of data
- Use of sources/types of information - circuit schedule etc.
- installation specifications, drawings/diagrams,
- Determining nature/characteristics of the fault with discussion with 'customer' (lecturer)
- Checking and testing
- Interpreting results/information
- Functional testing.

Unit 304

Electrical Installations: Inspection, Testing and Commissioning

UAN:	R/503/9954
Level:	Level 3
Credit value:	12
GLH:	110
Aim:	The unit is designed to enable learners to understand how to carry out inspection and testing of complex electrical systems safely and in accordance with regulatory requirements. Learners will also develop the skills to apply their understanding in simulated environments
Health and safety:	Health and safety behaviour learned in mandatory unit 201/501 should be displayed in all arenas.

Learning outcome
The learner will: 1. Understand the requirements for completing the safe isolation of electrical circuits and installations
Assessment criteria
The learner can: 1. state the requirements of the Electricity at Work Regulations for the safe inspection of electrical systems and equipment 2. specify the appropriate procedure for completing safe isolation 3. state the reasons for carrying out safe isolation 4. state the implications of carrying out safe isolation 5. state the implications of not carrying out safe isolation 6. identify the Health and Safety requirements which apply when inspecting, testing and commissioning electrical installations and circuits

Range
Requirements: In terms of: <ul style="list-style-type: none">• those carrying out the work• those using the premises during the inspection.
Procedure: Carrying out safe working practices:

<ul style="list-style-type: none"> • Identification of circuit(s) to be isolated • Identifying suitable points of isolation • Selecting correct test and proving instruments in accordance with relevant industry guidance and standards • Suitable testing methods • Selecting locking devices for securing isolation • Warning notices • Appropriate sequence for isolating circuits. <p>Reasons: In relation to:</p> <ul style="list-style-type: none"> • The inspector • Other personnel • Customers/clients • Public • Building systems. <p>Implications: In relation to:</p> <ul style="list-style-type: none"> • The inspector • Other personnel • Customers/clients • Public • Building systems (removal of supply). <p>Health and Safety requirements:</p> <ul style="list-style-type: none"> • Working in accordance with risk assessments / permits to work / method statements • Safe use of tools and equipment • Safe and correct use of measuring instruments • Provision and use of PPE • Reporting of unsafe situations.
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Learning outcome
The learner will:
2. Understand the requirements for initial verification of electrical installations
Assessment criteria
The learner can:
1. state the purpose of the Initial Verification of electrical installations
2. state the requirements of the initial verification
3. identify the relevant documents associated with the inspection, testing and commissioning of an electrical installation
4. specify the information that is required by the inspector to conduct the initial verification of an electrical installation

Range
Relevant documents:
<ul style="list-style-type: none"> • Electricity at Work Regulations • BS 7671

- IET Guidance Note 3
- HSE Guidance.

Learning outcome

The learner will:

3. Understand the requirements for completing the inspection of electrical installations prior to their being placed into service

Assessment criteria

The learner can:

1. select appropriate items to be checked during the inspection process
2. identify human senses appropriate for initial verification
3. state how the senses can be used during the inspection process
4. specify the **requirements for the inspection** of electrical installations
5. specify the requirements for the inspection to include:
 - a. special installations and locations as identified in Part 7 of BS 7671
 - b. IP Classification of equipment.

Range

Requirements for the inspection:

- Earthing conductors
- Earth electrodes
- Circuit protective conductors
- Main and supplementary protective bonding conductors
- Devices for isolation and switching
- Type and rating of overcurrent protective devices
- Type and rating of RCDs and RCBOs
- Barriers and Enclosures
- Containment systems (Steel and Plastic)
- Cables
- Conductors and terminations
- Electrical accessories.

Learning outcome

The learner will:

4. Understand the requirements for the safe testing and commissioning of electrical installations

Assessment criteria

The learner can:

1. state the tests to be carried out on an electrical installation in accordance with the BS 7671 and IET Guidance Note 3
2. identify the appropriate instrument for each test to be carried out in terms of:
 - a. The instrument is fit for purpose
 - b. Identifying the correct scale or setting.
3. specify the requirements for the safe use of instruments to be used

for testing and commissioning, to include:

- a. Checks required to prove that test instruments are safe and functioning correctly
 - b. The requirements for test leads and probes must comply with HSE Guidance GS38
 - c. The need for instruments to be regularly checked and calibrated.
4. explain why it is necessary for test results to comply with standard values
 5. state the actions to be taken in the event of unsatisfactory results being obtained
 6. explain why testing is carried out in the sequence specified in BS 7671 and IET Guidance Note 3

Learning outcome

The learner will:

5. Understand the requirements for testing before circuits are energised

Assessment criteria

The learner can:

1. state why it is necessary to verify continuity to include:
 - a. Protective bonding conductors
 - b. Circuit protective conductors
 - c. Ring final circuit conductors.
2. state the methods for verifying continuity to include:
 - a. Protective conductors
 - b. Ring final circuit conductors.
3. explain **factors that affect conductor resistance values**
4. specify the **procedures** for completing insulation resistance testing
5. state the effects on insulation resistance values that the following can have:
 - a. cables connected in parallel
 - b. variations in cable length.
6. explain why it is necessary to verify polarity
7. state the procedures for verifying polarity

Range

Factors that affect conductor resistance values:

- Cables connected in parallel
- Variations in cable length
- Variations in conductor cross sectional area.

Procedures:

- Precautions to be taken before conducting insulation resistance tests
- Methods of testing insulation resistance
- The required test voltages and minimum insulation resistance values for circuits operating at various voltages
- Identifying typical voltage sensitive devices
- Particular requirements for testing where there are voltage sensitive devices and/or surge protection devices installed.

Learning outcome

The learner will:

6. Understand the requirements for testing energised installations

Assessment criteria

The learner can:

1. state the procedures for confirming polarity of the incoming supply
2. specify the methods for measuring earth electrode resistance to include:
 - a. installations forming part of a TT system
 - b. generators and transformers.
3. describe **common earth fault loop paths**
4. state the **methods for verifying protection** by automatic disconnection of supply
5. identify the requirements for the measurement of prospective fault current
6. specify the methods for **determining prospective fault current**
7. verify the suitability of protective devices for prospective fault currents
8. specify the methods for testing the correct operation of residual current devices
9. state the reasons for verifying phase sequence
10. state the methods used to verify phase sequence
11. state the need for functional testing
12. identify items which require functional testing
13. state the appropriate **procedures for dealing with clients** during the commissioning and certification process

Range**Common earth fault loop paths:**

- TT
- TN-S
- TN-C-S.

Methods for verifying protection:

- The measurement of the external earth fault loop impedance (Z_e) and the system earth fault loop
- Impedance (Z_s)
- Establishing Z_e by enquiry
- Calculation of the value of Z_s from given information
- Comparing measured Z_s values with the maximum tabulated figures as specified in BS 7671 including the application of the correction factor.

Requirements for determining fault current:

- Single phase installations
- Three phase installations.

Procedures for dealing with clients:

- Ensuring the safety of others during the work activities
- Keeping clients informed during the process
- Labelling electrical circuits, systems and equipment that are still to be commissioned

- Providing clients with all the appropriate documentation upon work completion.

Learning outcome

The learner will:

7. Understand the requirements for the completion of electrical installation certificates and associated documentation

Assessment criteria

The learner can:

1. explain the purpose of certification and associated **documentation**
2. state the information that must be contained on initial verification **documentation**
3. describe the certification process for a completed installation
4. identify the responsibilities of different relevant personnel in relation to the completion of the certification process
5. explain the requirements for the recording and retention of completed initial verification documentation in accordance with the BS 7671

Range**Documentation:**

- An Electrical Installation Certificate
- A Minor Electrical Installation Works Certificate
- Schedule of Inspections
- Schedule of Test results.

Learning outcome

The learner will:

8. Be able to confirm safety of system and equipment prior to completion of inspection, testing and commissioning

Assessment criteria

The learner can:

1. carry out safe isolation procedures in accordance with regulatory requirements
2. comply with the Health and Safety requirements of themselves and others within the work location during the initial verifications process
3. check the safety of electrical systems prior to the commencement of inspection, testing and commissioning

Learning outcome

The learner will:

9. Be able to carry out inspection of electrical installations prior to them being placed into service

Assessment criteria

The learner can:

1. identify a safe system of work appropriate to the work activity

2. carry out an initial inspection of an electrical installation in accordance with the requirements of BS 7671 and IET Guidance Note 3
3. complete a Schedule of Inspections in accordance with BS 7671 and IET Guidance Note 3 based on engineering evaluation of the installation to be verified

Learning outcome

The learner will:

10. Be able to test electrical installations prior to them being placed into service

Assessment criteria

The learner can:

1. select the test instruments and their accessories for tests to include:
 - a. continuity
 - b. insulation resistance
 - c. polarity
 - d. earth electrode resistance
 - e. earth fault loop impedance
 - f. prospective fault current
 - g. RCD operation
 - h. phase sequence
 - i. functional testing.
2. evaluate the appropriate tests suitable for the installation to be verified
3. carry out tests in accordance with BS 7671, IET On-site Guide and Guidance notes 3 to include:
 - a. continuity including:
 - i. main protective bonding conductors
 - ii. circuit protective conductors
 - iii. Ring Final Circuits.
 - b. insulation resistance
 - c. polarity
 - d. external earth fault loop impedance (Z_e)
 - e. system earth fault loop impedance (Z_s)
 - f. prospective fault current
 - g. RCD operation including additional protection
 - h. phase sequence
 - i. functional testing.
4. confirm compliance by evaluating and verifying test results
5. complete appropriate documentation in accordance with the BS 7671 and IET Guidance Note 3 including:
 - a. Electrical Installation Certificate
 - b. Schedule of Inspections
 - c. Schedule of Test results.

Learning outcome

The learner will:

11. Be able to commission electrical systems and equipment

Assessment criteria

The learner can:

1. clarify the commissioning procedures with relevant persons
2. carry out the commissioning of circuits, accessories and equipment to confirm functionality

UAN:	K/503/9958
Level:	Level 3
Credit value:	12
GLH:	110
Aim:	This unit provides the learner with the understanding of electrical systems design using design techniques and determining system requirements. It also provides learners with the understanding needed to plan work programmes and contractual implications of electrical design
Health and safety:	Health and safety behaviour learned in mandatory unit 201 should be displayed in all arenas.

Learning outcome
The learner will: 1. Understand how to prepare for the installation of wiring systems
Assessment criteria
The learner can: 1. Describe how to plan and implement: a. work allocations b. duties of operatives for whom they are responsible c. coordination with other services and personnel. 2. identify relevant sources of information which will inform electrical work 3. describe the actions required to ensure that electrical work sites are correctly prepared in terms of Health and Safety considerations 4. state why it is important to check for any pre-existing damage to customer/client property prior to commencement of any work activity 5. explain how to check for any pre-existing damage to customer/client property : a. Equipment and components b. Building décor and floor finishes. 6. state the actions that should be taken if pre-existing damage to customer/client property is identified 7. specify methods for protecting the fabric and structure of the property before and during electrical work

Range
<p>Relevant sources of information:</p> <ul style="list-style-type: none"> • Statutory documents • Codes of Practice • British Standards • Site drawings • Installation specifications – Wiring diagrams; Fitting and Fixing dimensions/drawings; Technical data • Manufacturer's instructions. • Materials schedule • Bar charts • Spread sheets • Critical Path Analysis. <p>Actions required:</p> <ul style="list-style-type: none"> • Provision for safe access and egress • Checking immediate work location for potential hazards as appropriate to property, personnel and livestock • Know the requirements for the completion of a risk assessment • Confirm that appropriate risk assessments and method statements have been produced. • Provision of safe storage facilities <p>Customer/client property:</p> <ul style="list-style-type: none"> • Building wall/floor fabric.

Learning outcome
<p>The learner will:</p> <ol style="list-style-type: none"> 2. Understand the applications of wiring systems
Assessment criteria
<p>The learner can:</p> <ol style="list-style-type: none"> 1. explain the constructional features, applications, advantages and limitations of electrical cables 2. explain the characteristics of containment, support and wiring systems used in electrical installations 3. determine the size of conduit and trunking as appropriate to the size and number of cables 4. describe the factors which affect the selection of wiring systems, associated equipment and enclosures. 5. Assess and select suitable wiring systems and equipment appropriate to the situation and use

Range
<p>Electrical cables:</p> <ul style="list-style-type: none"> • Single and multicore thermosetting insulated cables including flexible cables • Single and multicore thermoplastic (PVC) and thermosetting insulated cables and flexible cables

- PVC/PVC flat profile cable
- MICC (with and without PVC sheath)
- SWA cables
- Armoured/braided flexible cables and cords
- Data cables
- Fibre optic cable
- Fire resistant cable.

Characteristics:

- Constructional features
- Applications
- Advantages
- Limitations.

Containment, support and wiring systems:

- Conduit (PVC and Metallic)
- Trunking (PVC and Metallic)
- Cable Tray
- Cable Basket
- Ladder systems
- Ducting
- Modular wiring systems
- Busbar systems and Powertrack.

Factors:

- Building
- Utilisation
- Environment
- Cost.

Wiring systems and equipment:

- Lighting systems
- Power systems (final circuits)
- Distribution systems (sub mains)
- Environmental control/building management systems
- Emergency management systems
- Security systems – Fire Alarm/Prevention; Unlawful Entry; Emergency Lighting
- Closed Circuit TV, communication and data transmission systems
- Escape routes.

Learning outcome

The learner will:

3. Understand the practices and procedures for carrying out electrical work

Assessment criteria

The learner can:

1. state the procedures for selecting and safely using appropriate hand tools, power tools and adhesives for electrical work

2. state the procedures for selecting and safely using equipment for measuring and marking out for wiring systems, equipment and enclosures
3. state the criteria for selecting and safely using tools and equipment for fixing and installing wiring systems, associated equipment and enclosures
4. state the **criteria** for selecting and safely using fixing devices for wiring systems, associated equipment and enclosures
5. assess and specify the installation methods and procedures to ensure that in accordance with the installation specification and statutory and non-statutory regulations:
 - a. wiring systems, enclosures, cables and components are securely fixed and installed
 - b. a wiring system's mechanical integrity is maintained
 - c. no damage to the wiring system or its components has occurred
6. specify methods and techniques for restoring the building fabric

Range

Criteria:

- Load bearing capacity
- Fabric of structure
- Environmental considerations
- Aesthetic considerations.

Learning outcome

The learner will:

4. Understand the characteristics and applications of supply systems and consumer's equipment

Assessment criteria

The learner can:

1. explain the characteristics and applications of **earthing arrangements**
2. explain the characteristics and applications of **supply systems**
3. specify the arrangements for electrical installations and systems with regard to provision for
 - a. Isolation and switching
 - b. Overcurrent protection
 - c. Earth fault protection.

Range

Earthing arrangements:

- TN-S
- TNC-S
- TN-C
- TT
- IT systems.

Supply systems:

- Single phase
- Three phase

- Three phase and neutral.

Learning outcome

The learner will:

5. Understand earthing and protection

Assessment criteria

The learner can:

1. explain the purpose of earthing and protective conductors
2. identify extraneous and exposed conductive parts
3. describe the requirements and measures for protection against electric shock
4. state the maximum disconnection time for different types of circuit
5. explain the earth fault loop path and earth fault loop impedance
6. specify requirements and applications of functional earthing
7. select suitably sized protective conductors in accordance with BS 7671

Learning outcome

The learner will:

6. Understand protection against overcurrent

Assessment criteria

The learner can:

1. identify types of and reasons for **overcurrent**
2. explain the operating principles, applications and limitations of **protective devices**
3. identify fault current capacities of devices
4. outline the need for discrimination between protective devices

Range**Overcurrent:**

- Short circuits
- Earth Faults
- Overloads.

Protective devices:

- Fuses
- CBs
- RCDs/RCBOs, circuit overload and short-circuit protection
- (BS3036, re-wireable, BS1361/2 cartridges, BS88 HBC).

Learning outcome

The learner will:

7. Understand electrical systems and circuits

Assessment criteria

The learner can:

1. describe the characteristics of standard **electrical circuits**
2. outline the key characteristics of particular **electrical systems and circuits** and the applications of these circuits and systems

Range

Electrical circuits:

- Lighting circuits
- Socket outlet circuits
- Supplies to fixed equipment.

Electrical systems and circuits:

- Distribution systems (sub mains)
- Environmental control/building energy management systems
- Emergency Lighting
- Security systems – Fire Alarm/Prevention; Unlawful Entry; Emergency Lighting
- UPS
- Closed Circuit TV, communication and data transmission systems
- Machine control
- Heating control.

Learning outcome

The learner will:

8. Understand the electrical design procedure

Assessment criteria

The learner can:

1. state the purpose of diversity factors
2. select suitable current using equipment giving consideration to energy efficiency and relevant codes of practice for sustainability
3. determine the maximum demand (of an installation) after the application of diversity
4. determine the design current
5. select a suitably rated protective device
6. establish the installation method reference
7. determine appropriate rating factors
8. determine the minimum cross-sectional area of live conductors taking into consideration current carrying capacity and voltage drop
9. establish if the voltage drop is acceptable
10. verify if the disconnection times have been achieved
11. evaluate thermal constraints
12. interpret the requirements of **sources of information** in the design of an installation

Range

Sources of information:

- BS 7671
- Guidance notes
- Other relevant standards.

Unit 308

Career awareness in building services engineering

UAN:	K/504/0253
Level:	Level 3
Credit value:	2
GLH:	20
Aim:	<p>This unit will introduce learners to the concept of planning for own career development and setting goals to help realise plans. Learners will investigate the different crafts that make up Building Services Engineering.</p> <p>Learners are required to compile documents to support career plans including Curriculum Vitae and personal statements.</p> <p>The unit is designed to demonstrate to learners that there are many optional career pathways including becoming highly skilled in own craft or exploring supervisory responsibilities.</p>

Learning outcome
The learner will: 1. Understand how to plan for careers in building services engineering
Assessment criteria
The learner can: 1.1 Identify resources to support career planning 1.2 Describe elements of career planning 1.3 Describe documents to support career development 1.4 Explain the principles of goal setting 1.5 Describe how to set goals 1.6 Define the different roles in building services engineering 1.7 Explain opportunities for progression within building services engineering.
Range
Resources Internet, publications, professional bodies/organisations, educational support and guidance, independent research, mentors, networking, job descriptions, role models, job centres, recruitment agencies, awarding

organisations.

Elements

Goal setting, qualifications, Curriculum Vitae (CV), person specification, aspirations, work experience, SWOT analysis.

Documents

Curriculum Vitae (CV), personal statement, portfolio, cover letter, references, business plans.

Principles

SMART targets, SWOT analysis.

Goals

Short, medium, long.

Roles

Installation electrician, heating and ventilation service and maintenance engineer, plumber, heating and ventilation engineer, refrigeration engineer, maintenance electrician, ductwork installer, air-conditioning engineer.

Opportunities for progression

Supervisor, manager, business owner, highly skilled in craft, sideways moves to different crafts, assessor/trainer, designer, surveyor, estimator, apprenticeship, engineer, director.

Types

Contract work, private, consultancy, sub-contractor, casual labour.

Learning outcome

The learner will:

2. Understand the requirements to become a qualified operative in building services engineering

Assessment criteria

The learner can:

- 2.1 Describe **specific requirements** for career choices in building services engineering
- 2.2 Identify the **areas** in building services which run competent person schemes
- 2.3 Define the **term competent person scheme (CPS)**
- 2.4 Identify the renewal requirements for being part of competent person schemes
- 2.5 Describe the **consequences** of not being part of the competent person scheme when working in building services engineering.

Range

Specific requirements

Qualifications, experience, competency, legal.

Areas

Gas, hot water, cold water, electrical, air conditioning, solid fuel, environmental technologies, oil.

Term competent person scheme (CPS)

To enable self-certification of own work carried out.

Consequences

Fines, imprisonment, loss of license to practice, injury.



Appendix 1 Relationships to other qualifications

Links to other qualifications

This qualification has connections to the:

- Level 2 Diploma in Electrical Installations (Buildings and Structures) (2365)
- Level 2 NVQ in Plumbing and Heating (6189)
- Level 3 NVQ in Plumbing and Heating (6189)
- Level 3 NVQ in Electrotechnical Services (2357)
- Level 2 NVQ in Heating and Ventilating (6188)
- Level 3 NVQ in Heating and Ventilating (6188)
- Level 2 NVQ in Refrigeration and Air Conditioning (6087)
- Level 3 NVQ in Refrigeration and Air Conditioning (6087)
- Level 2 Diploma in Plumbing Studies (6035)
- Level 3 Diploma in Plumbing Studies (6035)
- Level 2 Diploma in Heating and Ventilating (7188)
- Level 3 Diploma in Heating and Ventilating (7188)
- Level 2 Diploma in Refrigeration, Air Conditioning and Heat Pump Systems (7189)
- Level 3 Diploma in Refrigeration, Air Conditioning and Heat Pump Systems (7189)

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills Wales – see www.cityandguilds.com/esw



This document must be completed by the candidate and the tutor as part of the qualification induction.

You have been enrolled on the **Level 3 Diploma in Electrical Installations (Buildings and Structures) (2365-03)**. This is a qualification that tests both practical and knowledge based skills in a realistic working environment. When you have successfully completed this qualification you will be at an **Improver/Electrician's Mate** level.

In order to fully qualify as an Electrician you will need to fully meet the performance criteria as laid down in the National Occupational Standards put together by Summit Skills, the Sector Skills Council. This is covered in the City and Guilds 2357 Level 3 NVQ Diploma in Electrotechnical Technology.

Your tutor/assessor will be able to explain how you may progress onto the City and Guilds 2357 Level 3 NVQ Diploma in Electrotechnical Technology. **However, you should be aware that the relevant performance units will need to be carried out in industry.** Completion of the 2357 will enable you to apply to join an industry graded or competent person's scheme.

I can confirm that as part of my induction the above statement has been explained and I understand that completing the City and Guilds Level 3 Diploma in Electrical Installations (Buildings and Structures) (2365-03) qualification will not make me a fully qualified Electrician.

Candidate _____ Date _____

Tutor _____ Date- _____



Appendix 3 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on **www.cityandguilds.com**.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF):** general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for GOLLA/e-volve assessments.

Useful contacts

UK learners General qualification information	T: +44 (0)844 543 0033 E: learnersupport@cityandguilds.com
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: intcg@cityandguilds.com
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: singlesubjects@cityandguilds.com
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: intops@cityandguilds.com
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: walledgarden@cityandguilds.com
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: business@cityandguilds.com
Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

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feedbackandcomplaints@cityandguilds.com

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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Published by City & Guilds, a registered charity established to promote education and training

City & Guilds

1 Giltspur Street

London EC1A 9DD

T +44 (0)844 543 0000

F +44 (0)20 7294 2413

www.cityandguilds.com

HB-02-2365