City & Guilds Level 3 Electrotechnical Qualification (Installation) or (Maintenance) (5357-23)

Version 1.6 (September 2025)

Qualification Handbook

Qualification at a glance

Subject area	Electrical (Installation) and (Maintenance)
City & Guilds number	5357-23
Age group approved	16-18, 19+
Entry requirements	There are no formal entry requirements for this qualification. However, it is expected that apprenticeship learners have a Level 2 in English and Maths or are working towards achieving this by the end of their apprenticeship.
Assessment	Portfolio of evidence, assignments, multiple-choice question online tests
Grading	Pass/Fail
Approvals	Full approval or automatic approval
Support materials	Candidate logbook, Training manual, Sample assessments
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Regulatory reference number	GLH	TQT
City & Guilds Level 3 Electrotechnical Qualification	5357-23	601/6299/5	745	1042

Version and date	Change detail	Section
1.0 Sept 2023	Initial version	All
1.1 Nov 2023	Unit 102 - Learning Outcome 4 amend	Units
	Unit 113 – supporting information, reference to unit 312 title update	Units
1.2 Dec 2023	Test specification table for unit 004	Assessment
1.3 Dec 2024	Unit 101/001 Learning Outcome 4, assessment criteria 1 amended	Units
1.4 Feb 2025	IET Wiring regulations title update	Test Specifications
1.5 April 2025	Handbook transferred to latest version of the template. The section on Quality Assurance has been updated and sections on Inclusion and diversity, and Sustainability have been added.	Throughout
1.6 September 2025	Updated Access arrangements and reasonable adjustments to Access arrangements, reasonable adjustments and special consideration	Access arrangements, reasonable adjustments and special consideration
	Added section on Artificial Intelligence (AI)	Delivering the qualification
	Added statement on ordering of assessments	Assessment of the qualification
	Updated statement on workplace supervision	Assessment strategy
	Clarified time limit for Recognition of prior learning (RPL)	Recognition of prior learning (RPL)
	Appendix 2: Sources of general information updated	Appendix 2

Contents

Introduction

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

Area	Description
Who is the qualification for?	This qualification meets the needs of learners in England and Northern Ireland who want to work as electricians, installing systems and equipment in buildings, structures and the environment, within the Electrotechnical industry. It is a mandatory requirement of the Electrotechnical apprenticeship frameworks in England and Northern Ireland.
What does the qualification cover?	The qualification allows the candidate to develop the knowledge, skills and competency required for an Installation and Maintenance Electrician in the Electrotechnical sector.
What opportunities for progression are there?	- On successful completion of this qualification, learners can progress on to City & Guilds Level 4 Award in the Design and Verification of Electrical Installations. - The Electrotechnical qualification will also enable learners to progress within employment.
Who did we develop the qualification with?	The qualification has been developed in collaboration with industry stakeholders and a wide group of employers who set the apprenticeship standard from which the qualification was derived.
Is it part of an apprenticeship framework or initiative?	England and Northern Ireland Apprenticeship frameworks for Installation Electricians and Maintenance Electricians.

Grading

This qualification is graded as pass/fail.

Structure

To achieve the City & Guilds Level 3 Electrotechnical Qualification (Installation) learners must achieve all the mandatory units, along with specialist unit **109 Apply Design and Installation Practices and Procedures**

To achieve City & Guilds Level 3 Electrotechnical Qualification (Maintenance) learners must achieve all the mandatory units, along with specialist unit **110 Apply Practices and Procedures for Maintenance**

City & Guilds Level 3 Electrotechnical Qualification				
UAN	**Unit number**	**Unit title**	**Assessment Method**	**GLH**
Mandatory				
J/507/0649	101 001	Understand Health, Safety and Environmental Considerations	Assignment Online MCQ test	65
A/507/0650	102	Apply Health, Safety and Environmental Considerations	Portfolio	10
F/507/0651	103 003	Electrical Scientific Principles and Technologies	Assignment Online MCQ test	115
J/507/0652	104 004	Understand Design and Installation Practices and Procedures	Assignment Online MCQ test	170
L/507/0653	105 505	Understand how to Plan and Oversee Electrical Work Activities	Assignment Online MCQ test	40
R/507/0654	106	Organise and Oversee the Electrical Work Environment	Portfolio	12
Y/507/0655	107	Understand Terminations and Connections of Conductors	Assignment	93
D/507/0656	118	Termination and Connection of Conductors	Portfolio	12
H/507/0660	312 212	Inspection, Testing and Commissioning	Assignment Online MCQ test	80
K/507/0661	113	Inspect, Test and Commission Electrical Systems	Portfolio	16
M/507/0662	114 014	Understand Fault Diagnosis and Rectification	Assignment Online MCQ test	32

T/507/0663	115	Apply Fault Diagnosis and Rectification	Portfolio	10
	022	Understand the Requirements for Electrical Installations BS 7671:2018 (2022)	Online MCQ test	70
Specialist unit (1 from)				
H/507/0657	109	Apply Design and Installation Practices and Procedures	Portfolio	20
K/507/0658	110	Apply Practices and Procedures for Maintenance	Portfolio	20

Total Qualification Time (TQT)

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT comprises of the following two elements:

1) the number of hours that an awarding organisation has assigned to a qualification for guided learning
2) an estimate of the number of hours a learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by – but, unlike guided learning, not under the immediate guidance or supervision of – a lecturer, supervisor, tutor or other appropriate provider of education or training.

Title and level	GLH	TQT
City & Guilds Level 3 Electrotechnical Qualification	745	1042

Centre requirements

Approval

Full approval

To offer this qualification, new centres will need to gain both centre and qualification approval. Please refer to the document **Centre Approval process: Quality Standards** for further information.

Automatic approval

If your centre is approved to offer the 2357-13, 2357-23 or 5357-03, you will be automatically approved to offer the new 5357-23. Please refer to the document **Centre Approval process: Quality Standards** for further information.

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

Resource requirements

Centre staffing

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

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training (this knowledge must be to the same level as the training being delivered)
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Continuing professional development (CPD)

Centres are expected to support their staff in ensuring that their knowledge remains current of the occupational area and of best practice in delivery, mentoring, training, assessment and quality assurance, and that it takes account of any national or legislative developments.

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City & Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

Standards and rigorous quality assurance are maintained by the use of:

- Internal quality assurance
- City & Guilds external quality assurance.

In order to carry out the quality assurance role, Internal Quality Assurers must:

- have appropriate teaching and vocational knowledge and expertise
- have experience in quality management/internal quality assurance
- hold or be working towards an appropriate teaching/training/assessing qualification
- be familiar with the occupation and technical content covered within the qualification.

Assessors

Assessors must be working towards or have achieved a relevant recognised assessor qualification such as a Level 3 Certificate in Assessing Vocational Achievement and continue to practice to that standard. Assessors who hold earlier

qualifications (D32 or D33 or TQFE/TQSE) should have CPD evidence to the most current standards.

They must be occupationally competent electricians. Evidence which supports this is by the assessor holding a relevant electrotechnical NVQ L3* and/or having registration with the JIB as 'Approved Electrician' status or Eng-Tech status via the IET.

*Assessors who qualified before NVQs were developed should provide evidence of how they are occupationally competent (such as through a CV together with any relevant references).

Assessors must be able to demonstrate evidence of being up to date with the electrical industry. This can be evidenced for example by either accessing trade publications, undertaking updates to wiring regulations or other course of learning, attending networking events relevant to this qualification and/or attending industry events. They must also satisfy any other Awarding Organisation requirements.

Internal Quality Assurers

Internal quality assurers must have a minimum of occupational experience evidenced by having a building services engineering related qualification or proven sector competence/experience plus access to relevant 'occupational expertise' to enable them to conduct their role as an **internal quality assurer**. This evidence and access to 'occupational expertise' is quality assured by the Awarding Organisation.

They must be working towards or have achieved a relevant recognised internal quality assurance qualification such as the Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practice and continue to practice to that standard. Assessors who hold earlier qualifications (D34 or V1) should have CPD evidence to the most current standards.

They must be able to demonstrate evidence of being up to date with building services engineering industry. This can be evidenced for example by either accessing trade publications, undertaking courses of learning, attending networking events relevant to this qualification and/or attending industry events.

Expert Witnesses

Where **"Expert Witnesses"** are used in the assessment process identified above they must be Sector competent individuals who can attest to the learner's performance in the workplace,

It is not necessary for expert witnesses to hold an assessor qualification, as a qualified assessor they must assess the performance evidence provided by an expert witness. Evidence from expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency.

Expert witnesses will need to demonstrate:

1. They have relevant current knowledge of industry working practices and techniques

2. That they have no conflict of interest in the outcome of their evidence

Markers - Technically competent

Where centre-based assessments are marked by a person who does not come into the assessor category as above, the marker must have auditable technical competence in the subject. As an example, for a scientific based assessment the person may have auditable competency in that subject area but not necessarily electrotechnical installation or maintenance.

Teachers/Instructors

Teachers/instructors involved with the delivery of the knowledge units must demonstrate an understanding of the topics/technical content in this qualification. As a minimum they must have achieved a relevant technical qualification to at least level 3 which covers the key topics in this qualification.

Examples of evidence for this are: City & Guilds Level 2 plus Level 3 Certificates in Electrical Installation Part One and Part Two or EAL L3 Diploma in Electrotechnical Services. Other electrical engineering qualifications such as OND, or HNC/D etc. An example of ***not*** meeting this requirement is by only holding a L2 VRQ or a L3 Award – as clearly this person has not demonstrated technical/academic ability to the level of the qualification being delivered.

Teachers/instructors of practical work should in addition to the above be technically skilled for their instruction. This can be evidenced for example though a CV, JIB grading at an appropriate grade, membership of an institution eg EngTech, MIET.

All teachers/instructors must hold (or be working toward) a recognised teaching qualification (to a minimum of L3 standard) such as: Level 3 Award in Preparing to Teach in the Lifelong Learning Sector (PTLLS).

Teachers/ Instructors must be able to demonstrate evidence of being up to date with the electrical industry. This can be evidenced for example by either accessing trade publications, undertaking updates to wiring regulations or other courses of learning, attending networking events relevant to this qualification and/or attending industry events.

External Quality Assurance

External quality assurance for the qualification will be provided by City & Guilds EQA process. EQAs are appointed by City & Guilds to approve centres, and to monitor the assessment and internal quality assurance carried out by centres. External quality assurance is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres.

The role of the EQA is to:

- provide advice and support to centre staff
- ensure the quality and consistency of assessments and marking/grading within and between centres by the use of systematic sampling
- provide feedback to centres and to City & Guilds.

Learner entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that learners have the potential and opportunity to gain the qualification successfully. It is expected that apprenticeship learners have Level 2 English and Maths by the end of their apprenticeship programme.

Age restrictions

This qualification is approved for learners aged 16 or above.

Access arrangements, reasonable adjustments and special consideration

City & Guilds has considered the design of this qualification and its assessments in order to best support accessibility and inclusion for all learners. order to best support accessibility and inclusion for all learners. City & Guilds understands however that individuals have diverse learning needs and may require reasonable adjustments to fully participate. Reasonable adjustments, such as additional time or alternative formats, may be provided to accommodate learners with disabilities and support fair access to assessment.

Access arrangements are adjustments that allow candidates with disabilities, special educational needs, and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

The Equality Act 2010 requires City & Guilds to make reasonable adjustments where a disabled person would be at a substantial disadvantage in undertaking an assessment.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Special consideration is a post examination adjustment to a candidate's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/assessment.

Please refer to the documents 'Joint Council for Qualifications (JCQ) Access Arrangements and Reasonable Adjustments', 'JCQ – A Guide to the special consideration process' and

‘Access arrangements – When and how applications need to be made to City & Guilds’ for more information. All of these are available on the **City & Guilds website**.

Delivering the qualification

Initial assessment and induction

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

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

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

Inclusion and diversity

City & Guilds is committed to improving inclusion and diversity within the way we work and how we deliver our purpose which is to help people and organisations develop the skills they need for growth. More information and guidance to support centres in supporting inclusion and diversity through the delivery of City & Guilds qualifications can be found here:

Inclusion and diversity | City & Guilds (cityandguilds.com)

Sustainability

City & Guilds are committed to net zero. Our ambition is to reduce our carbon emissions by at least 50% before 2030 and develop environmentally responsible operations to achieve net zero by 2040 or sooner if we can. City & Guilds is committed to supporting qualifications that help our customers to consider sustainability and their environmental footprint.

More information and guidance to support centres in developing sustainable practices through the delivery of City & Guilds qualifications can be found here:

Our Pathway to Net Zero | City & Guilds (cityandguilds.com)

Centres should consider their own carbon footprint when delivering this qualification and consider reasonable and practical ways of delivering this qualification with sustainability in mind. This could include:

- reviewing purchasing and procurement processes (such as buying in bulk to reduce the amount of travel time and energy and considering and investing in the use of

components that can be reused, instead of the use of disposable or single use consumables)
- reusing components wherever possible
- waste procedures (ensuring that waste is minimised and recycling of components is in place wherever possible)
- minimising water use and considering options for reuse/salvage as part of plumbing activities wherever possible.

Artificial Intelligence (AI)

City & Guilds has published a Position Statement on AI including guidance on its use. This is designed to help learners, tutors and assessors to complete Non-Exam Assessments (NEAs), coursework and other internal assessments successfully. Staff delivering this qualification must ensure familiarity with the statement.

Support materials

The following resources are available for this qualification:

Description	How to access
Candidate logbook	www.cityandguilds.com
Sample assessments	www.cityandguilds.com
Assessment packs	www.cityandguilds.com
Assessor guidance	www.cityandguilds.com
SmartScreen	www.smartscreen.co.uk

Assessment

Assessment of the qualification

The qualification is assessed through a variety of assessment methods. The knowledge units include:

- online tests
- written paper
- projects or assignments
- practical observations

These units will be assessed at the candidate's training provider and centres should refer to assessor guidance for rules on test conditions. The performance units will be evidenced through a workplace evidence record which will form part of the candidates' portfolio. The performance units should be assessed through naturally occurring opportunities whilst in the workplace. The workplace evidence record allows candidates to demonstrate the practical skills and associated knowledge required of an electrical apprentice.

Learners must have received the appropriate underpinning knowledge and skills training to undertake the assessment outlined in the performance units safely and correctly. Assessment must only occur when the learner is suitably prepared and ready.

Learners must:

- successfully complete all assessments for each mandatory unit
- successfully complete all assessments for the chosen specialist unit.

Assessment Types		
Assessment type	**Assessment method**	**Where to obtain assessment materials**
Assignments	Centrally set and centre marked assignments open or closed book (to be stated). These do not require invigilation but must be the work of the candidate, marked by technically competent staff and quality assured by the centre and City & Guilds.	Assessment packs can be accessed from www.cityandguilds.com

Projects	Externally set and internally marked, open book research and scenario-based assignments. These do not require invigilation but must be the work of the candidate, marked by technically competent staff, quality assured by the centre and City & Guilds.	Assessment packs can be accessed from www.cityandguilds.com
Online MCQ test / e-volve	City & Guilds online e-volve multiple-choice question test. The test samples knowledge from the unit content. These tests are externally set and externally marked.	Examinations provided on e-volve.
Question Paper	Externally set and internally marked open or closed book (to be stated) controlled assessment carried out under controlled invigilated conditions. Marked by technically competent staff and quality assured by the centre and City & Guilds.	Assessment packs can be accessed from www.cityandguilds.com
Practical observation	Demonstration of knowledge under assessment conditions open or closed book (to be stated). Observed and controlled by a qualified assessor and quality assured by the centre and City & Guilds.	Assessment packs can be accessed from www.cityandguilds.com
Workplace evidence logbook	This assessment designed to capture all evidence in the workplace that meets the performance units of this qualification. Evidence that is sourced from the real working environment for performance units must be naturally occurring and assessed on a minimum of two occasions.	The workplace evidence logbook can be accessed from www.cityandguilds.com

Assessment strategy

City & Guilds has written assignments to use with this qualification:

- live assignments that can be downloaded from the City & Guilds website
- sample assignments that can be downloaded from the City & Guilds website.

A common assessment strategy has been produced jointly by awarding organisations to ensure the consistency of the assessments offered across awarding organisations.

For unit 101 learners who successfully complete both the assignment (101) and the e-volve test (001) and are a registered apprentice with the JIB they will be exempt from having to do the ECS Health and Safety Assessment. Providers will be able to apply for ECS cards on behalf of all of their Trailblazer apprentice.

There are expanded assessment requirements **(England only*)** for the units:

102: Apply Health and Safety and Environmental Considerations

109: Apply Design and Installation Practices and Procedures

110: Apply Practices and Procedures for Maintenance

118: Termination and Connection of Conductors

At least one of the on-site assessments of performance for each of the above units must occur in a commercial or industrial setting, i.e. on-site assessment cannot occur exclusively in a domestic context.

Domestic premises are:

- designed to accommodate a single family;
- houses in multiple occupation comprising a number of self-contained units, each designed to accommodate a single person or family;
- sheltered housing, dwelling units;
- supported housing.

This includes, bungalows, resident areas of care homes, multi-storey houses, individual flats and maisonettes, apartment buildings, mobile homes, holiday homes, sheltered housing, shared houses and houses divided into several self-contained single-family dwelling units, and student accommodation.

This does not include large or extensive communal areas used by residents of more than one single dwelling. Large or extensive communal residential areas may suffice for the commercial / industrial assessment requirement. Examples of these areas would be large catering kitchens in care homes, student accommodation communal areas such as receptions, bathrooms intended for the use of more than one residential unit, boiler rooms servicing several individual dwellings, service risers or stairways and landings servicing many individual flats, typically with an incoming three-phase electricity supply etc.

Learners must be adequately supervised in the workplace in accordance with relevant legislation. This is particularly important when working toward the

performance units involving working at heights, inspecting, testing, and diagnosing faults, or other activities involving working on or near to live parts.

Important note - AM2S

This handbook contains all the assessment information needed to pass all the units within this qualification. However, for the learner to achieve the **apprenticeship in England or Northern Ireland**, they also need to successfully complete the AM2S synoptic competence- based assessment. No assessment in this qualification will contribute to the overall grade of the apprenticeship in England or Northern Ireland which is determined solely by the AM2S.

The AM2S is a robust, timed (16.5 hours typically over 2 and a half days) practical and theory (40 multiple-choice questions) assessment in sections, requiring learners to perform a set of common tasks and procedures that a full scope electrical operative might face when working in commercial or industrial premises as well as dwellings. It assesses learners on installation, inspection and testing and fault-finding; their work must comply with BS 7671, be in line with relevant health and safety legislation and conform to current industry practices and procedures.

The AM2S will be graded pass/merit/distinction and weighting of practical to theory of 70% / 30%.

Portfolio of evidence

Some units are assessed through a portfolio of evidence. All evidence in the portfolio for the skills learning outcomes must be generated in the workplace or a realistic working environment.

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence candidates' progress towards achieving qualifications. Further details are available at **www.cityandguilds.com/eportfolios**.

City & Guilds has developed a set of **recording forms** within the **logbook** to use as appropriate. Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external quality assurers, before they are used by candidates and assessors at the centre.

Evidence sources

A portfolio of evidence will typically include several pieces of evidence – it must contain sufficient evidence to demonstrate the knowledge and skills required for each appropriate unit.

Evidence sources may include:

- annotated photographs
- video clips (maximum duration in total = 10 minutes)
- workplace documentation/records, for example job cards/job sheets, equipment check/maintenance/service records, parts order records.

This is not a definitive list; other evidence sources are permitted.

The evidence provided must be valid and attributable to the candidate; the portfolio of evidence must contain a statement from the centre confirming this.

Evidence **must not** include:

- any methods of self-assessment

Employer contributions should focus on direct observation of evidence (for example witness statements) of competence rather than opinions.

Time constraints

The following must be applied to the assessment of this qualification:

- Centre staff should guide learners to ensure excessive evidence gathering is avoided.
- All assignments/tasks must be completed and assessed within the learner's period of registration. Centres should advise learners of any internal timescales for the completion and marking of individual assignments.

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification.

RPL is allowed and is also sector-specific. Please refer to the RPL/exemption document on **cityandguilds.com** for further details.

There is no longer a time limit for when a previously achieved qualification can be used for RPL (this was 5 years for the Level 3 Electrotechnical Qualification and the Level 3 Electrotechnical in Dwellings). However, the knowledge and understanding must be valid, current, reliable, and attributed to the learner. Caution must be applied to RPL using qualifications exceeding a 5-year time frame, and it must have prior EQA approval before RPL is applied. For previously achieved qualifications to be considered current, relevant and auditable continued professional development (CPD) may be used to validate this.

Test specifications

The way the knowledge is covered by each test is laid out in the tables below:

5357-001: Understand Health, Safety and Environmental Considerations			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand how relevant legislation applies in the workplace	4	16
2	Understand the procedures for dealing with environmental and health and safety situations in the work environment	6	24
3	Understand the procedures for establishing a safe working environment	7	28
4	Understand the requirements for identifying and dealing with hazards in the work environment	8	32
	Total	25	100%

Assessment method: Online multiple-choice question test

Duration: 40 mins

Grading: Pass/Fail

Grade boundaries: Pass is approximately 60 %

Permitted material: Closed book, non-programmable calculator

5357-003: Electrical Scientific Principles and Technologies			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand mathematical principles which are appropriate to electrical installation, maintenance and design work	2	5
2	Understand standard units of measurement used in electrical installation, maintenance and design work	5	13
3	Understand basic mechanics and the relationship between force, work, energy and power	7	18
4	Understand the relationship between resistance, resistivity, voltage, current and power	15	37
5	Understand the fundamental principles which underpin the relationship between magnetism and electricity	7	17
6	Understand the types, applications and limitations of electronic components in electrotechnical systems and equipment	4	10
	Total	40	100%

Assessment methods: Online multiple-choice question test

Duration: 90 mins

Grade boundaries for this test will be:

Pass: 50 %

Merit: 65 %

Distinction: 80 %

Resit e-volve (unit 303); Pass only: 50%

Permitted materials: Closed book, non-programmable calculator

5357-103: Electrical Scientific Principles and Technologies			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
7	Understand electrical supply systems	6	23
8	Understand how different electrical properties can affect electrical circuits, systems and equipment	8	31
9	Understand the operating principles and applications of DC machines and AC motors	4	15
10	Understand the operating principles of electrical components	3	11
11	Understand the principles and applications of electrical lighting systems	3	11
12	Understand the principles and applications of electrical heating	2	8
	Total	26	100%

Assessment methods: Short-answer question paper

Duration: 120 mins

Grade boundaries:

for the first sitting of this test will approximately be:

Pass: 50 %

Merit: 65 %

Distinction: 80 %

for resits of this test will approximately be:

Pass: 50%

Please note: The resits for this assessment are capped to a Pass grade only.

When re-sitting candidates can no longer achieve merit or distinction.

Permitted materials: Closed book, non-programmable calculator

5357-004: Understand Design and Installation Practices and Procedures			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
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	27
6	Understand protection against overcurrent	5	17
7	Understand electrical systems and circuits	3	9
	Total	27	100%

Assessment methods: Online multiple-choice question test

Duration: 70 mins

Grading: Pass/Fail

Grade boundaries: Pass is approximately 70%

Permitted materials: BS 7671; IET On-site Guide, non-programmable calculator

5357-505: Understand how to plan and oversee electrical work activities			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand the requirements for liaising with others when organising and overseeing work activities	10	63
3	Understand the requirements for organising the provision and storage of resources that are required for work activities	6	37
	Total	16	100%

Assessment methods: Online multiple-choice question test

Duration: 40 mins

Grading: Pass/Fail

Grade boundaries: Pass is approximately 60%

Permitted materials: Closed book, non-programmable calculator

5357-212: Inspection, Testing and Commissioning			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand the requirements for completing the safe isolation of electrical circuits and installations	6	17
2	Understand the requirements for inspection of electrical installations	2	6
3	Understand the requirements for completing the inspection of electrical installations prior to their being placed into service	Assessed by assignment	
4	Understand the requirements for the safe testing and commissioning of electrical installations	8	23
5	Understand the requirements for testing before circuits are energised	7	20
6	Understand the requirements for testing energised installations	10	28
7	Understand the requirements for the completion of documentation	2	6
	Total	35	100%

Assessment methods: Online multiple-choice question test

Duration: 80 minutes

Grading: Pass/Fail

Grade boundaries: Pass is approximately 60%

Note: Learning outcomes 8-11 will be assessed through a practical observation

Permitted materials: Closed book, non-programmable calculator

5357-014: Understand Fault Diagnosis and Rectification			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand the health and safety requirements relevant to fault diagnosis	3	10
2	Understand the importance of reporting and communication in fault diagnosis	2	7
3	Understand the nature and characteristics of electrical faults	6	20
4	Understand the fault diagnosis procedure	10	33
5	Understand the procedures and techniques for correcting electrical faults	9	30
	Total	30	100%

Assessment methods: Online multiple-choice question test

Duration: 60 mins

Grading: Pass/Fail

Grade boundaries: Pass is approximately 60%

Note: learning outcome 6 will be assessed through a practical observation

Permitted material: Closed book, non-programmable calculator

5357-022: Understand the Requirements for Electrical Installations BS 7671:2018 (2022)			
Learning Outcome number	**Learning Outcome**	**Number of questions**	**Percentage %**
1	Understand the scope, object and fundamental principles of BS 7671	4	7
2	Understand the definitions used within BS 7671	2	3
3	Understand how to assess the general characteristics of electrical installations	6	10
4	Understand requirements of protection for safety for electrical installations	15	25
5	Understand the requirements for selection and erection of equipment for electrical installations	14	23
6	Understand the requirements of inspection and testing of electrical installations	4	7
7	Understand the requirements of special installations or locations as identified in BS 7671	7	12
8	Understand the information contained within Part 8 and the appendices of BS 7671	8	13
	Total	60	100%

Assessment methods: Online multiple-choice question test

Duration: 120 mins

Grading: Pass/Fail

Pass Mark: The pass mark for this examination is set at approx. 60%

Permitted material: IET Wiring Regulations 18th Edition: BS 7671:2018 (2022) Requirements for Electrical Installations

Requirements for electrical Installations: BS 7671:(2018) 2022 including amendment 3 (2024): IET Wiring Regulations

Non-programmable calculator

Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- title
- level
- guided learning hours (GLH)
- unit aim
- assessment type
- learning outcomes, which are comprised of a number of assessment criteria
- range statements / lists
- supporting information

Guidance for delivery of the units

This qualification comprises of a number of **units**. A unit describes what is expected of a competent person in particular aspects of their job.

Each **unit** is divided into **learning outcomes** which describe in further detail the skills and knowledge that a candidate should possess.

Each **learning outcome** has a set of **assessment criteria** (performance and knowledge and understanding) which specify the desired criteria that must be satisfied before an individual can be said to have performed to the agreed standard.

Range statements define the breadth or scope of a learning outcome and its assessment criteria by setting out the various circumstances in which they are to be applied.

Supporting information provides guidance of the evidence requirement for the unit and specific guidance on delivery and range statements. Centres are advised to review this information carefully before delivering the unit.

Unit 101/001 Understand Health, Safety and Environmental Considerations

Level:	3
GLH:	65
Assessment type:	Online multiple-choice question test (001) and practical assignment (101)
Aim:	This unit will provide learners with an understanding of the relevant health and safety legislation, practices and procedures when installing and maintaining electrical systems and equipment. The knowledge covered in this unit underpins the practical application of health and safety legislation, practices and procedures.

Learning outcome

The learner will:

LO1 understand how relevant legislation applies in the workplace

Assessment criteria

The learner can:

AC1.1 identify **roles** and responsibilities with regard to current **relevant health and safety legislation**

AC1.2 identify roles and responsibilities with regard to **relevant environmental legislation**

Range

Roles:

- Employers
- Employees
- Organisations
- Clients.

Relevant health and safety legislation:

- 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:

LO2 understand the procedures for dealing with environmental and health and safety situations in the work environment

Assessment criteria

The learner can:

AC2.1 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

AC2.2 specify **appropriate procedures** which should be followed when emergency situations occur in the workplace

AC2.3 state the actions to be taken in situations which exceed their level of responsibility for health and safety in the workplace

AC2.4 specify **appropriate responsible persons** to whom health and safety and welfare related matters should be reported.

AC2.5 describe the **ways in which the environment may be affected by work activities**

AC2.6 specify the current **requirements and good working practices** for processing waste on site

AC2.7 explain why it is important to report any hazards to the environment that arise from work procedures

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Range

Appropriate procedures:

- Procedures for summoning emergency services
- Information that emergency services require
- Alarm and evacuation procedures
- Designated escape routes
- Firefighting 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:

LO3 be able to demonstrate and understand the procedures for establishing a safe working environment

Assessment criteria

The learner can:

AC3.1 state the procedure for producing risk assessments and method statements in accordance with their level of responsibility
AC3.2 describe the procedures that should be taken to remove or minimise risks before deciding PPE is needed
AC3.3 state the purpose of PPE
AC3.4 specify the appropriate protective clothing and equipment that is required for

identified work tasks

AC3.5 state the first aid facilities that must be available in the work area in accordance with health and safety regulations

AC3.6 explain why it is important not to misuse first aid equipment/supplies and to replace first aid supplies once used

AC3.7 describe and demonstrate safe practices and **procedures** for the use of **equipment and materials** in the working environment

AC3.8 specify and demonstrate the procedures for ensuring electrical systems are safe to work on

AC3.9 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.

Equipment and materials:

- 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.

Implications:

- Self
- Others
- Building systems.

Learning outcome

The learner will:

LO4 understand the requirements for identifying and dealing with hazards in the work environment

Assessment criteria

The learner can:

AC4.1 identify warning pictograms for hazardous substances, as defined by the GB (Great Britain) CLP (Classification, Labelling and Packaging) Regulation
AC4.2 define what is meant by the term hazard in relation to health and safety legislation in the workplace
AC4.3 identify **specific hazards** associated with the installation and maintenance of electrical systems and equipment
AC4.4 describe **situations** which can constitute a hazard in the workplace
AC4.5 explain practices and procedures for addressing **hazards in the work place** (inferred through practical)
AC4.6 identify the correct type of fire extinguisher for a particular type of fire
AC4.7 explain situations **where asbestos may be encountered**
AC4.8 specify the procedures for dealing with the suspected presence of asbestos in the workplace

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Range

Specific hazards:

- Electric shock (direct and indirect contact)
- Burns
- Fires
- Explosions.

Situations:

- 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.

Unit 101/001 Understand Health, Safety and Environmental Considerations

Supporting information

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.

For unit 101 candidates who successfully complete both the assignment (101) and the e-volve test (001) and are a registered apprentice with the JIB they will be exempt from having to do the ECS Health and Safety Assessment. Providers will be able to apply for ECS cards on behalf of all of their Trailblazer apprentices.

Unit 102 Apply Health, Safety and Environmental Considerations

Level:	3
GLH:	10
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable learners to develop the skills and apply the relevant knowledge associated with health and safety legislation, practices and procedures when installing and maintaining electrical systems and equipment.

Learning outcome
The learner will:

LO1 be able to apply relevant health and safety legislation in the workplace

Assessment criteria
The learner can:

AC1.1 identify which workplace health and safety procedures are relevant to the working environment and comply with their duties and obligations as defined by current legislation and organisational procedures

AC1.2 produce a risk assessment and method statement in accordance with organisational procedures for a given work activity

AC1.3 work within the requirements of:

a. risk assessments
b. method statements
c. safe systems of work.

Learning outcome
The learner will:

LO2 be able to assess the work environment for hazards and identify remedial actions in accordance with Health and Safety legislation

Assessment criteria
The learner can:

AC2.1 identify unsafe situations and conditions and take remedial actions

AC2.2 assess the work environment and revise work practices accordingly to take into account hazards which could cause harm, including the handling of potentially hazardous:

a. materials
b. tools
c. equipment.

AC2.3 identify any hazards which may present a high risk and report their presence to relevant persons who have overall responsibility for health and safety in the workplace

AC2.4 apply measures to control health and safety hazards

AC2.5 select and use correct personal protective equipment

Learning outcome

The learner will:

LO3 be able to apply methods and procedures to ensure work on site is in accordance with health and safety legislation

Assessment criteria

The learner can:

AC3.1 demonstrate a level of personal conduct and behaviour within the workplace, to ensure that the health and safety of themselves and others is not endangered

AC3.2 apply procedures to ensure the safe use, maintenance and storage of tools, plant and equipment as stipulated in:

a. workplace policies (company and site)
b. supplier information
c. manufacturer's instructions.

AC3.3 comply with information, warning, mandatory instruction and prohibition notices

AC3.4 apply procedures to ensure the safety of the work location through the correct use of guards barriers and notices

AC3.5 use **access equipment** correctly

Range

Access equipment:

Assess two from the following:

- ladder
- tower scaffold or MEWP
- stepladder
- platform.

Learning outcome

The learner will:

LO4 Be able to work in accordance with environmental legislation for electrical services

Assessment criteria

The learner can:

AC4.1 demonstrate appropriate procedures for the safe handling, storage and disposal of hazardous materials and products, in accordance with one of the following:

- Environmental Protection Act
- the Hazardous Waste Regulations
- Pollution Prevention and Control Act
- Control of Pollution Act
- the Control of Noise at Work Regulations
- Environment Act.

Unit 102 Apply Health, Safety and Environmental Considerations

Supporting Information

Notes for guidance

Prior to undertaking this unit a learner must provide auditable evidence that they have the relevant knowledge and understanding as detailed in the unit:

- Unit 101 – Understand Health, Safety and Environmental considerations for electrical systems

Evidence requirements

Learning Outcomes 1 to 5:

Auditable evidence sourced from a real working environment must be provided to illustrate that, the learner has demonstrated on two separate occasions they can apply health and safety legislation and working practices when Installing and Maintaining Electrical Systems and Equipment in accordance with approved industry practices, statutory and non-statutory regulations and the assessment criteria for each of the learning outcomes.

In this unit the learner is subject to direct observation on at least **two** separate occasions in the workplace by a qualified assessor. Reflective accounts will not be accepted as evidence for this unit. Any outstanding performance criteria that are not met through the direct observation must be supplemented by alternate evidence provided by the employer.

As a minimum, **one** of the two direct observations must be a physical, face to face, site visit with an assessor, the second direct observation may be live streamed online assessment with an assessor. On both occasions this should be fully documented and made available for quality assurance.

Unit 103/003 Electrical Scientific Principles and Technologies

Level:	3
GLH:	115
Assessment type:	Online multiple-choice question test (003) or (303 for resit), centre marked written question paper and practical assignment (103)
Aim:	This unit is designed to enable learners to understand the relationship between electrical scientific principles and the competencies required of a qualified electrical operative. Its content is the knowledge needed by a learner to underpin the application of skills in the installation and maintenance of electrical systems and equipment.

Learning outcome

The learner will:

LO1 understand mathematical principles which are appropriate to electrical installation, maintenance and design work

Assessment criteria

The learner can:

AC1.1 identify and apply appropriate **mathematical principles** which are relevant to electrical work tasks

Range

Mathematical principles:

- Fractions and percentages
- Algebra
- Indices
- Transposition
- Triangles and trigonometry
- Statistics.

Learning outcome

The learner will:

LO2 understand standard units of measurement used in electrical installation, maintenance and design work

Assessment criteria

The learner can:

AC2.1 identify and use internationally recognised base and derived **(SI) units of measurement**

AC2.2 identify and determine values of base and derived SI units which apply specifically to **electrical quantities**

AC2.3 identify appropriate electrical instruments for the measurement of different **electrical quantities**

Range

(SI) Units of measurement for:

- Length
- Area
- Volume
- Mass
- Density
- Time
- Temperature
- Velocity.

Electrical quantities (SI units):

- Resistance
- Resistivity
- Power
- Frequency
- Current
- Voltage
- Energy
- Impedance
- Inductance and inductive reactance
- Capacitance and capacitive reactance
- Power factor.

Electrical quantities (measurement):

- Resistance
- Power
- Current
- Voltage
- Energy.

Learning outcome
The learner will:

LO3 understand basic mechanics and the relationship between force, work, energy and power

Assessment criteria
The learner can:

AC3.1 specify what is meant by mass and weight
AC3.2 explain the principles of basic mechanics as they apply to **levers**, gears and pulleys
AC3.3 describe the main principles of the following and their inter-relationships:
  a. force
  b. work
  c. energy (kinetic and potential)
  d. power
  e. efficiency.
AC3.4 calculate values of mechanical energy, power and efficiency

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Range
Levers:
- class I
- class II
- class III

Learning outcome
The learner will:

LO4 understand the relationship between resistance, resistivity, voltage, current and power

Assessment criteria
The learner can:

AC4.1 describe the basic principles of electron theory
AC4.2 identify and distinguish between materials which are good conductors and insulators
AC4.3 describe what is meant by resistance and resistivity in relation to electrical circuits
AC4.4 explain the relationship between current, voltage and resistance in parallel and series DC circuits
AC4.5 calculate the values of current, voltage and resistance in parallel and series DC circuits
AC4.6 calculate values of power in parallel and series DC circuits
AC4.7 state what is meant by the term voltage drop in relation to electrical circuits
AC4.8 describe the chemical and thermal effects of electric currents

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Learning outcome
The learner will:

LO5 understand the fundamental principles which underpin the relationship

between magnetism and electricity

Assessment criteria

The learner can:

AC5.1 describe the effects of magnetism in terms of attraction and repulsion
AC5.2 state the difference between magnetic flux and flux density
AC5.3 describe the magnetic effects of electrical currents in terms of:
- a. production of a magnetic field
- b. force on a current-carrying conductor in a magnetic field
- c. electromagnetism
- d. electromotive force.

AC5.4 describe the basic principles of generating an AC supply in terms of:
- a. a single-loop generator
- b. sine-wave
- c. frequency
- d. EMF
- e. magnetic flux.

AC5.5 identify the **characteristics of sine-waves**

Range

Characteristics of a sine-wave:

- Root Mean Square (RMS) value
- Average value
- Peak to peak value
- Periodic time
- Frequency
- Amplitude.

Learning outcome

The learner will:

LO6 understand the types, applications and limitations of electronic components in electrical systems and equipment

Assessment criteria

The learner can:

AC6.1 describe the function and application of electronic components that are used in **electrical systems**
AC6.2 state the basic operating principles of **electronic components and devices**

Range

Electrical systems:

- Security alarms
- Telephones
- Dimmer switches

- Heating/boiler controls
- Motor control
- Wireless control systems

Electronic components and devices:

- Capacitors
- Resistors
- Rectifiers
- Diodes
- Zener
- LED
- photo
- Thermistors
- Diacs
- Triacs
- Transistors
- Thyristors
- Invertors.

Learning outcome

The learner will:

LO7 understand electrical supply systems

Assessment criteria

The learner can:

AC7.1 describe how electricity is generated and transmitted for domestic and industrial/commercial consumption

AC7.2 specify the **features and characteristics** of a generation and transmission system

AC7.3 state the basic operating principles of **other sources** of electricity

AC7.4 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.

AC7.5 identify types of transformers

AC7.6 describe the **operating principles, applications and limitations** of transformers

AC7.7 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:

- Power Stations
- Fossil fuels
- Hydro

- Nuclear
- Super-grid and standard grid system
- Transformers
- Transmission voltages
- Distribution voltages
- Sub-stations
- Above and below ground distribution.

Other sources:

- Electrical energy storage systems (EESS)
- CPS and UPS systems
- Solar power (thermal and photovoltaic)
- Wind energy
- Wave energy
- Micro hydro
- Combined Heat and Power (CHP) including micro CHP
- Electric vehicle systems (import and export)
- Inverters, and rectifiers.

Operating principles, applications and limitations:

- Iron loss
- Copper loss
- Relationship between current and voltage
- Primary and secondary windings
- Step up and step down transformers.

Learning outcome

The learner will:

LO8 understand how different electrical properties can affect electrical circuits, systems and equipment

Assessment criteria

The learner can:

AC8.1 explain the relationship between resistance, inductance, capacitance and impedance
AC8.2 determine **electrical quantities** in alternating current circuits
AC8.3 explain the relationship between kW, kVAr, kVA and power factor
AC8.4 calculate power factor
AC8.5 explain what is meant by power factor correction
AC8.6 specify methods of power factor correction
AC8.7 determine the neutral current in a three-phase and neutral supply and why systems should be balanced
AC8.8 calculate values of voltage and current in star and delta connected systems

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Range

Electrical quantities:

- Resistance
- Inductance

- Inductive reactance
- Capacitance
- Capacitive reactance
- Impedance.

Learning outcome

The learner will:

LO9 understand the operating principles and applications of DC machines and AC motors

Assessment criteria

The learner can:

AC9.1 state the basic types, applications and describe the operating principles of **DC machines**
AC9.2 describe the operating principles of **AC motors**
AC9.3 state the basic types, applications and limitations of **AC motors**
AC9.4 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:

LO10 understand the operating principles of electrical components

Assessment criteria

The learner can:

AC10.1 specify the main types and operating principles of **electrical components**

Range

Electrical components:

- Contactors
- Relays
- Solenoids
- Over-current protection devices:
    - Fuses (HRC, cartridge and semi-enclosed)
    - Circuit-breakers (including types)
    - RCBOs (including types)
    - RCDs (including types)
    - SPDs.

Learning outcome

The learner will:

LO11 understand the principles and applications of electrical lighting systems

Assessment criteria

The learner can:

AC11.1 explain the basic principles of illumination and state the applications of:

a. Inverse square law
b. Cosine law
c. Lumen method.

AC11.2 explain the operating principles, types, limitations and applications of **luminaires**

Range

Luminaires:

- General Lighting Service (GLS):
    - Tungsten
    - Halogen
- Discharge lighting:
    - Low and high pressure mercury vapour
    - Low and high pressure sodium vapour
    - Metal halide
- Energy saving (such as compact fluorescent lamps)
- LED
- dimmer types and settings
- cap/connection types
- beam angle
- driver types
- colour temperature
- efficacy

Learning outcome

The learner will:

LO12 understand the principles and applications of electrical heating

Assessment criteria

The learner can:

AC12.1 explain the basic principles of electrical space heating and electrical water heating
AC12.2 explain the operating principles, types, limitations and applications of **electrical space and water heating appliances and components**

Range

Electrical space and water heating appliances and components:

- Convection cycle
- Conduction
- Radiation
- Immersion heaters
- Storage heaters
- Convector heaters
- Under floor heating
- heat pumps (ground and air source)
- Controls, timers and programmers for heating systems.

Unit 103/003 Electrical Scientific Principles and Technologies

Supporting Information

Notes for guidance

Practical support learning activity

Given the safety-critical nature of this topic it is a requirement that learners will have their knowledge consolidated by the use of ‘Practical Support Learning’ activity in simulated conditions as appropriate.

In the delivery of this unit an 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 104/004 Understand Design and Installation Practices and Procedures

Level:	3
GLH:	170
Assessment type:	Online multiple-choice question test (004) and practical assignment (104)
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to design, prepare and install wiring systems and associated equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome:

The learner will:

LO1 understand how to prepare for the installation of wiring systems

Assessment criteria

The learner can:

AC1.1 identify **relevant sources of information** which will inform electrical work
AC1.2 describe the **actions required** to ensure that electrical work sites are correctly prepared in terms of health and safety considerations
AC1.3 state why it is important to check for any pre-existing damage to **customer/client property** prior to commencement of any work activity
AC1.4 explain how to check for any pre-existing damage to **customer/client property**:
  a. Equipment and components
  b. Building décor and floor finishes.
AC1.5 state the actions that should be taken if pre-existing damage to customer/client property is identified
AC1.6 specify methods for protecting the fabric and structure of the property before and during electrical work

Range

Relevant sources of information:

- Statutory documents
- Codes of Practice
- British Standards
- Site drawings
- Installation specifications – Wiring diagrams; Fitting and Fixing dimensions/drawings; Technical data
- Manufacturer's instructions.

Actions required:
- 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.

Customer/client property:
- Building wall/floor fabric

Learning outcome

The learner will:

LO2 understand the applications of wiring systems

Assessment criteria

The learner can:

AC2.1 explain the constructional features, applications, advantages and limitations of **electrical cables**
AC2.2 explain the **characteristics** of **containment, support and wiring systems** used in electrical installations
AC2.3 determine the size of conduit and trunking as appropriate to the size and number of cables
AC2.4 describe the **factors** which affect the selection of **wiring systems, associated equipment** and enclosures**.**
AC2.5 Assess and select suitable wiring systems and equipment appropriate to the situation and use

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Range

Electrical cables:
- 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 including PoE
- Fibre optic cable
- Fire resistant cable
- DC cabling.

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)c
- 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 (broadband, wired networks and WI-FI).
- Wired and wireless lighting or power control.
- Escape routes
- Electric vehicle charging circuits and equipment:

Learning outcome

The learner will:

LO3 understand the practices and procedures for carrying out electrical work

Assessment criteria

The learner can:

AC3.1 state the procedures for selecting and safely using appropriate hand tools, power tools and adhesives for electrical work

AC3.2 state the procedures for selecting and safely using equipment for measuring and marking out for wiring systems, equipment and enclosures

AC3.3 state the criteria for selecting and safely using tools and equipment for fixing and installing wiring systems, associated equipment and enclosures

AC3.4 state the **criteria** for selecting and safely using fixing devices for wiring systems, associated equipment and enclosures

AC3.5 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

AC3.6 specify methods and techniques for restoring the **building fabric**

Range

Criteria:

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

Building fabric:

- Fire and acoustic protection
- Restoration (eg plaster, foam fillers, masonry, stud walls, ceilings, insulation, fire compartments, fire resistance ratings, historic building techniques (eg lath and plaster).

Learning outcome

The learner will:

LO4 understand the characteristics and applications of supply systems and consumer's equipment

Assessment criteria

The learner can:

AC4.1 explain the characteristics and applications of **earthing arrangements**

AC4.2 explain the characteristics and applications of **supply systems**

AC4.3 specify the arrangements for electrical installations and systems with regard to provision for

a. Isolation and switching (including DC isolators)
b. Overcurrent protection
c. Earth fault protection
d. Arc fault detection
e. Surge protection

Range

Earthing arrangements:

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

- Neutral current diversion appearing on earthing systems.

Supply systems:
- Single phase
- Three phase
- Three phase and neutral.
- Other local sources of supply and equipment electric vehicle exporting/importing energy, prosumers and island mode systems, smart and dumb metering, load control/shedding,

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Learning outcome
The learner will:

LO5 understand earthing and protection

Assessment criteria
The learner can:

AC5.1 explain the purpose of earthing and protective conductors
AC5.2 identify extraneous and exposed conductive parts
AC5.3 describe the requirements and measures for protection against electric shock
AC5.4 state the maximum disconnection time for different types of circuit
AC5.5 explain the earth fault loop path and earth fault loop impedance
AC5.6 specify requirements and applications of functional earthing
AC5.7 select suitably sized protective conductors in accordance with BS 7671

Learning outcome
The learner will:

LO6 understand protection against overcurrent

Assessment criteria
The learner can:

AC6.1 identify types of and reasons for **overcurrent**
AC6.2 explain the operating principles, applications and limitations of **protective devices**
AC6.3 identify fault current capacities of devices
AC6.4 outline the need for selectivity between protective devices

---

Range

Overcurrent:
- Short circuits
- Earth Faults
- Overloads.

Protective devices:
- Fuses (BS 3036, re-wireable, BS1362 cartridge, BS 88).
- Circuit breakers (CBs)
- RCDs/RCBOs,
- Combined RCBO and AFDD

Learning outcome
The learner will:

LO7 understand electrical systems and circuits

Assessment criteria
The learner can:

AC7.1 describe the characteristics of standard **electrical circuits**
AC7.2 outline the key characteristics of particular **electrical systems and circuits** and the applications of these circuits and systems

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Range
Electrical circuits:
- Lighting circuits
- Socket outlet circuits
- Supplies to fixed equipment
- Older wiring systems and practices

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.
- Communication and data transmission systems (broadband, wired networks and WI-FI)
- Wireless controls
- Electric vehicle charging circuits and equipment:
- Electrical accessibility aids (eg stair lifts, hoists/person lifters, assisted living technologies, person alert systems).

Learning outcome
The learner will:

LO8 understand the electrical design procedure

Assessment criteria
The learner can:

AC8.1 state the purpose of diversity factors
AC8.2 select suitable current using equipment giving consideration to energy efficiency and relevant codes of practice for sustainability
AC8.3 determine the maximum demand (of an installation) after the application of diversity
AC8.4 determine the design current
AC8.5 select a suitably rated protective device
AC8.6 establish the installation method reference

AC8.7 determine appropriate rating factors
AC8.8 determine the minimum cross-sectional area of live conductors taking into consideration current carrying capacity and voltage drop
AC8.9 establish if the voltage drop is acceptable
AC8.10 verify if the disconnection times have been achieved
AC8.11 evaluate thermal constraints
AC8.12 interpret the requirements of **sources of information** in the design of an installation

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Range

Sources of information:

- BS 7671
- Guidance notes
- Other relevant standards.

Unit 104/004 Understand Design and Installation Practices and Procedures

Supporting Information

Notes for guidance

In the delivery of this unit an 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 105/505 Understand How to Plan and Oversee Electrical Work Activities

Level:	3
GLH:	40
Assessment type:	Online multiple-choice question test (505) and written open-book assignment / research-based project (105)
Aim:	This unit is designed to enable learners to understand the practices and procedures used when planning electrical installation and maintenance work activities. Its content is the knowledge needed by a learner to underpin the application of skills for overseeing and organising the work environment.

Learning outcome

The learner will:

LO1 understand the requirements for liaising with others when organising and overseeing work activities

Assessment criteria

The learner can:

AC1.1 describe techniques for the communication with **others** for the purpose of:
- a. motivation
- b. instruction
- c. monitoring
- d. co-operation and teamwork

AC1.2 describe **methods** of determining the competence of operatives for whom they are responsible

AC1.3 specify procedures for re-scheduling work to co-ordinate with changing conditions in the workplace and to coincide with other trades

AC1.4 specify **organisational procedures** for completing the documentation that is required during work operations

Range

Others:

- Customers
- Clients
- Site managers
- Major Contractors (where appropriate)

- Sub-contractors (where appropriate)
- Other services
- The public
- Employer.

Note: With reference to the above range this includes learners to perform to their highest standard and to work within the conduct expected of an employee in the industry. Such standards are of high importance when co-operating with employer and/or customer during work activities.

Methods:

- Checking competency cards (eg. CSCS cards, JIB cards)
- Checking technical qualifications
- Written references from previous employers
- Informal monitoring of performance on site
- Checking Continuing Professional Development (CPD)
- Competent Person Scheme Registration.

Organisational Procedures:

- Variation order
- Day worksheets
- Timesheets
- Site diary
- Requisitions
- Delivery note.

Learning outcome

The learner will:

LO2 understand the requirements for organising and overseeing work programmes

Assessment criteria

The learner can:

AC2.1 describe how to plan and implement:
  a. work allocations
  b. duties of operative for whom they are responsible
  c. coordination with other services and personnel.

AC2.2 state the procedures for carrying out work activities that will:
  a. maintain the safety of the work environment
  b. maintain cost effectiveness
  c. ensure compliance with the programmes of work.

AC2.3 identify the **industry standards** that are relevant to activities carried out during the installation of electrical systems and equipment, including the **current editions**

AC2.4 evaluate within the scope of the work programme and operations the responsibilities of themselves and others

AC2.5 identify the **procedures** for dealing with changes to an original contract specification

AC2.6 identify installations that require specialist advice or guidance:
  a. hazardous installations

b. installations outside the scope of BS 7671.

AC2.7 explain how the work completion time is estimated taking into account **influential factors**

AC2.8 state the possible consequences of not:

a. completing work within the estimated time
b. meeting the requirements of the programme of work
c. using the specified materials
d. installing materials and equipment as specified.

AC2.9 specify and evaluate methods of producing and illustrating **work programmes**

Range

Current editions of industry standards:

- Management of health and safety regulations
- Health & Safety at Work Act
- Electricity at Work regulations
- Construction design and management
- BS 7671 requirements for electrical installations
- BS EN graphical symbols
- Employment Rights Act
- Data Protection Act
- Equality Act
- Human Rights Act.

Procedures:

- Variation order
- Day work sheets
- Implications to work programme.

Influential factors:

- The deployment and availability of suitable personnel
- The delivery and availability of equipment, components and material
- Weather conditions
- Work to be completed by other services
- Specification variations.

Work programmes:

- Bar charts
- Spread sheets
- Critical Path Analysis.

Learning outcome

The learner will:

LO3 understand the requirements for organising the provision and storage of resources that are required for work activities

Assessment criteria

The learner can:

AC3.1 interpret the installation specification and work programme to identify **resource** requirements

AC3.2 interpret the material schedule to confirm that materials available are:

a. the right type
b. fit for purpose
c. in the correct quantity
d. suitable for work to be completed cost efficiently.

AC3.3 specify the storage and transportation requirements for all materials required in the work location

AC3.4 specify procedures to ensure the safe and effective storage of materials, tools and equipment in the work location

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Range

Resource:

- Materials
- Components
- Plant
- Vehicles
- Equipment
- Labour
- Tools
- Measuring and test instruments.

Unit 106 Organise and Oversee the Electrical Work Environment

Level:	3
GLH:	12
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable learners to develop the skills required, and apply the associated knowledge, so that they can demonstrate that they can implement practices and procedures for overseeing and organising the work environment for the installation of electrical systems and equipment.

Learning outcome
The learner will:

LO1 be able to provide relevant people with technical and functional information for work on electrical systems and equipment

Assessment criteria
The learner can:

AC1.1 liaise with relevant people to evaluate the information they require to ensure that systems, equipment or components can be operated safely and effectively

AC1.2 identify appropriate technical and functional information that is required for the work activity

AC1.3 provide information in a timely, courteous, suitable and professional manner in accordance with organisational procedures and engineering standards

Learning outcome
The learner will:

LO2 be able to oversee health and safety during work on electrical systems and equipment

Assessment criteria
The learner can:

AC2.1 produce, or revise generic, risk assessments and method statements, to cover their own work and others working the area (colleagues and other operatives) in accordance with their level of responsibility

AC2.2 implement suitable procedures to confirm that work is being completed in

accordance with health and safety legislation and industry standards

Learning outcome
The learner will:

LO3 be able to co-ordinate liaison with other relevant persons during work activities

Assessment criteria
The learner can:

AC3.1 select effective procedures to ensure co-ordination with other workers/contractors, including steps to resolve issues which are outside the scope of their job role

AC3.2 evaluate and apply communication techniques that are clear, accurate and appropriate to the situation

AC3.3 demonstrate working effectively with colleagues to enhance performance (Such as: undertaking work to the one's best ability, being a good employee/worker. Co-operating with the employer and/or customer during work activities.)

Learning outcome
The learner will:

LO4 be able to organise and oversee work activities and operations

Assessment criteria
The learner can:

AC4.1 organise operatives by allocating duties and responsibilities to make the best use of their competence and skill

AC4.2 monitor the work of operatives to ensure it is in accordance with:

a. industry working practices
b. programme of work
c. health and safety requirements
d. cost effectiveness
e. environmental considerations.

AC4.3 evaluate and apply appropriate procedures to correct issues that arise during work activities

Learning outcome
The learner will:

LO5 be able to organise a programme for working on electrical systems and equipment

Assessment criteria
The learner can:

AC5.1 produce a simple programme of work from the work specification, including requirements for the following:

a. estimate of the amount of time required for completion of the work
b. liaison with other trades where necessary.

AC5.2 communicate with others clearly and concisely

AC5.3 assess situations when it is necessary to liaise with other relevant parties to resolve issues.

Learning outcome

The learner will:

LO6 be able to organise the resource requirements for work on electrical systems and equipment

Assessment criteria

The learner can:

AC6.1 organise provision of **resources**

AC6.2 confirm that materials available are:

a. the right type
b. fit for purpose
c. in the correct quantity
d. suitable for work to be completed cost efficiently.

AC6.3 ensure that resources are undamaged at the point of delivery

AC6.4 demonstrate effective measures which ensure the safe and effective storage of materials, tools and equipment in the work location

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Range

Resources:

- Materials
- fixings
- Plant
- Labour
- Tools.

Unit 106 Organise and Oversee the Electrical Work Environment

Supporting Information

Notes for guidance

Prior to undertaking this unit a learner must provide auditable evidence that they have the relevant knowledge and understanding as detailed in the unit:

- Unit 105 Understand How to Plan and Oversee Electrical Work Activities

Evidence requirements

Learning Outcomes 1 to 6 - Auditable evidence sourced from a real working environment must be provided to illustrate that, the learner has demonstrated on two separate occasions they can implement practices and procedures for overseeing and organising the work environment for the installation of electrical systems and equipment in accordance with the assessment criteria for each of the learning outcomes.

In the delivery of this unit an 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 107 Understand Terminations and Connections of Conductors

Level:	3
GLH:	93
Assessment type:	Practical assignment with supplementary oral or written questioning
Aim:	This unit is designed to enable learners to understand and interpret the principles, practices and legislation associated with the termination and connection of conductors and cables in electrical systems. Its content is the knowledge needed by a learner to underpin the application of skills for terminating and connecting conductors and cables in electrical systems in accordance with statutory and non-statutory regulations/requirements.

Learning outcome:

The learner will:

LO1 understand the regulatory requirements and procedures for terminating and connecting conductors and cables in electrical wiring systems and equipment

Assessment criteria

The learner can:

AC1.1 identify and interpret appropriate **sources of relevant information** for the termination and connection of conductors and cables in electrical wiring systems and equipment

AC1.2 describe methods and procedures appropriate to the installation environment to ensure the safe and effective termination and connection of conductors and cables in electrical **wiring systems and equipment**

Range

Sources of relevant information:

- Statutory documents
- Codes of practice
- British standards
- BS 7671
- Manufacturers' instructions
- Installation specifications.

Wiring systems and equipment:

- 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.

Learning outcome

The learner will:

LO2 understand the procedures and applications of different methods of terminating, connecting and supporting conductors and cables in electrical wiring systems and equipment

Assessment criteria

The learner can:

AC2.1 explain the advantages, limitations and applications of the following connection methods:

a. screw
b. crimped
c. soldered
d. non-screw compression
e. insulation displacement.
f. compact lever
g. DC rated terminals.

AC2.2 describe the procedures for verifying that terminations and connections are electrically and mechanically sound

AC2.3 explain the consequences of terminations not being electrically and mechanically sound in terms of:

a. high resistance joints
b. corrosion and erosion.

AC2.4 interpret and apply the techniques and methods for the **safe** and effective termination and connection of:

a. flexible cables
b. single and multicore thermoplastic (PVC) and thermosetting insulated cables
c. PVC/PVC flat profile cable
d. MICC
e. SWA cables
f. Galvanised steel wire braid
g. data cables
h. fire performance cable
i. DC cables

AC2.5 apply techniques and methods for **effective support** of cables

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Range

Safe:

- Selection and use of tools
- PPE
- Risk assessment
- Reporting of unsafe situations
- Adherence to relevant statutory and non-statutory regulations.

Effective support:

- PVC conduit
- Metal conduit
- Metal trunking
- Metal tray.

Unit 107 Understand Terminations and Connections of Conductors

Supporting Information

Notes for guidance

Practical support learning activity

Given the safety-critical nature of this topic it is a requirement that learners will have their knowledge consolidated by the use of ‘Practical Support Learning’ activity in simulated conditions. Assessment criteria 4.5 is supported by learning outcomes from unit 104 Understand design and installation practices and procedures.

In the delivery of this unit an 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 118 Termination and Connection of Conductors

Level:	3
GLH:	12
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to terminate and connect conductors and cables in electrical systems in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome
The learner will:

LO1 prepare to terminate and connect cables and conductors

Assessment criteria
The learner can:

AC1.1 evaluate and apply appropriate procedures to include:
- a. Selecting appropriate tools/equipment to enable termination and connection
- b. Adopting appropriate PPE
- c. Following a safe system of work (eg. risk assessment, method statement, permit to work procedure).

AC1.2 assess and confirm it is safe to complete termination and connection in terms of:
- a. Checking for presence of supply/carrying out safe isolation
- b. Mechanical soundness of the electrical equipment to be connected to
- c. Checking for unsafe situations.

Learning outcome
The learner will:

LO2 terminate and connect conductors and cables

Assessment criteria

The learner can:

AC2.1 terminate and connect cables and conductors in accordance with manufacturers instructions, BS 7671, and any relevant drawing or specification

Assess five from the following:

a. Single core (singles)
b. Multicore insulated
c. PVC - PVC flat profile cable
d. MICC
e. Fire performance
f. SWA cable
g. GSWB galvanised steel wire braid
h. Data / PoE
i. DC Cabling

AC2.2 connect to electrical equipment in accordance with manufacturers instructions, BS 7671, and any relevant drawing or specification

Assess five from the following:

a. Isolators /switches
b. Socket outlets
c. Distribution-boards / consumer control units
d. Luminaires
e. Electric motors / motor control equipment
f. Overcurrent protective devices
g. Earthing terminals
h. Control panels
i. Data socket outlets or data connections
j. Fire detection/alarm components
k. Other appropriate equipment (such as: heating system components, fire detection components, smart camera, smart lighting or heating control) (N.B an individual smart lamp is not sufficient)

AC2.3 terminate and connect conductors, using appropriate methods

Assess two from the following:

a. Screwing
b. Crimping
c. Soldering
d. Non-screw compression
e. Insulation displacement.

AC2.4 ensure that terminations and connections are electrically and mechanically sound (Eg. by simple inspecting and testing terminations)

AC2.5 ensure cables have appropriate identification in accordance with BS 7671

Unit 109 Apply Design and Installation Practices and Procedures

Level:	3
GLH:	20
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to plan, prepare and install wiring systems and associated equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome

The learner will:

LO1 prepare to install wiring systems, enclosures and associated equipment

Assessment criteria

The learner can:

AC1.1 assess and apply appropriate procedures to include:
- a. Adopting appropriate PPE
- b. Following a safe system of work (eg. working in accordance with a risk assessment and method statement)
- c. Selecting appropriate tools/equipment for the installation work.

AC1.2 prepare to install wiring systems, enclosures and associated equipment, to include:
- a. Confirm secure site storage facilities for tools, equipment, materials and components
- b. Select materials (equipment and components) in accordance with the installation specification
- c. Report any pre-work damage/defects to existing equipment or building features, to the relevant person (Such as: customer/client, site/line manager
- d. Confirm site readiness for installation work to begin
- e. Confirm authorisation for the installation work to start.

AC1.3 use documentation to confirm that materials and equipment is of the correct quantity and is free from damage

AC1.4 ensure the planned locations for the wiring system and associated equipment are compatible with other building services (eg. gas, water or other electrical services)

AC1.5 check the planned locations for the wiring system in terms of:

a. Cosmetic appearance
b. External influences.

Learning outcome

The learner will:

LO2 interpret appropriate information for the installation of wiring systems, enclosures and associated equipment

Assessment criteria

The learner can:

AC2.1 use sources of information to enable the installation of wiring systems, enclosures and associated equipment to be carried out including:

a. Specifications
b. Work schedules/programmes
c. Manufacturer instructions
d. Layout Drawings
e. Other appropriate source of information (eg. BS 7671, other plans or diagrams, 'approved documents', building regulations)

Learning outcome

The learner will:

LO3 install wiring systems, and equipment in accordance with current relevant statutory and non-statutory regulations

Assessment criteria

The learner can:

AC3.1 use appropriate measuring and marking out techniques which are appropriate to the wiring system, wiring enclosure and/or associated equipment that is being installed

AC3.2 install cables in accordance with BS 7671, the installation specification and programme of work: Assess five from:

a. Single core (singles)
b. Multicore insulated
c. PVC - PVC flat profile cable
d. MICC
e. Fire performance
f. SWA cable
g. GSWB galvanised steel wire braid
h. Data / PoE
i. DC cabling.

AC3.3 install the following in accordance with the wiring regulations, the installation

specification and agreed planned programme of work:

PVC: Containment: Minimum of one:

a. PVC Trunking
b. PVC Conduit

And Metallic: Containment: Minimum of one:

a. Metallic Conduit
b. Metallic Trunking)

And Minimum of one from the following:

a. Cable Tray
b. Cable Basket
c. Ladder systems
d. Ducting
e. Modular wiring systems
f. Busbar systems or Powertrack.

AC3.4 install the following types of electrical equipment and accessories, in accordance with, BS 7671, the installation specification, manufacturers' instructions and the programme of work: Assess five from the following:

a. Isolators /switches
b. Socket-outlets
c. Distribution-boards / consumer control units
d. Overcurrent protective devices
e. Luminaires
f. Data socket outlets / WiFi Router
g. electric vehicle charging point
h. Other appropriate equipment (eg. heating system components, control equipment, fire detection components, smart camera, smart lighting or heating control) (N.B an individual smart lamp is not sufficient)

AC3.5 communicate with others professionally and appropriately to aid the effective installation of the wiring system/equipment

AC3.6 dispose of waste materials in accordance with site procedures and statutory requirements

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Learning outcome

The learner will:

LO4 confirm the quality of the completed work

Assessment criteria

The learner can:

AC4.1 ensure the installed wiring system/s and enclosure/s meet specified requirements including that they:

a. Are the correct type and fit for purpose
b. Are installed in accordance with BS 7671
c. Meet the installation specification/other relevant plans/instructions
d. Are installed in accordance with any relevant manufacturer instructions.

Unit 110 Apply Practices and Procedures for Maintenance

Level:	3
GLH:	20
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to maintain electrical systems and equipment in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 Wiring Regulations • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome

The learner will:

LO1 prepare to carry out electrical maintenance

Assessment criteria

The learner can:

AC1.1 produce a maintenance work plan following best practice procedures to include:

a. analysing the requirements of task, (based on technical and engineering principles and know-how)
b. planned shut downs/isolations
c. health and safety precautions (eg. provision for release of stored and latent energy)
d. permits to work
e. organising tools, equipment and spare parts
f. liaison with/co-ordination of work with other persons will be necessary
g. time/cost effectiveness
h. A method statement (to include the appropriate best practice techniques/procedures/methods to undertake the maintenance activity).

AC1.2 use appropriate methods to communicate the plan/or key aspects of the planned work to relevant people such as: other workers, colleagues and clients

AC1.3 perform maintenance duties effectively as part of a team (such as: with the employer, other workers etc.)

AC1.4 assess and apply appropriate preparation procedures to include:

a. Adopting appropriate PPE
b. Obtaining authorisation to carry out the maintenance work (such as a permit to work)
c. Notifying relevant personnel of the maintenance work (other trades, users of equipment etc.)
d. Following risk assessments.

AC1.5 select appropriate tools and equipment for the maintenance work:

a. Hand tools/power tools:
    i. Access equipment
    ii. Calibrated test instruments together with leads to GS 38 (as appropriate).
    iii. Positioning/lifting/jacking equipment
    iv. Trolleys/hand operated jacks.
b. Following a safe system of work (eg. working in accordance with a risk assessment and method statement)
c. Secure the work areas (fences, barriers, screens and warning signs).

AC1.6 ensure relevant shutdown procedures are followed and safe isolation has been carried out (eg. electrical systems/pressurised systems (hydraulic/compressed air/water, gas))

AC1.7 assess and confirm secure storage facilities for tools, equipment, materials and components

AC1.8 confirm that all appropriate job information is available for use

Assess five from:

a. Maintenance schedules/specifications
b. Maintenance programmes
c. drawings/diagrams
d. Regulatory documents (eg. current version of BS 7671
e. Method statements
f. servicing records
g. Manufacturer's instructions
h. Certificates of competency
i. Permits to work
j. Other relevant information.

AC1.9 verify that proposed materials/equipment/components are in accordance with:

a. Industry requirements (best practice)
b. The type of installation, its use, and the environment in which it is installed.

AC1.10 ensure permission for the proposed work has been given (eg. from the client)

Learning outcome

The learner will:

LO2 carry out electrical maintenance

Assessment criteria

The learner can:

AC2.1 interpret the maintenance schedule/specification to accurately identify and locate electrical systems and equipment that is to be worked upon

AC2.2 use appropriate tools, equipment and materials for maintenance work

AC2.3 apply best practice work procedures which are appropriate for the type of maintenance activity being undertaken (planned preventative, breakdown, monitored)

AC2.4 apply best practice work procedures which are in accordance with:

a. Manufacturer's instructions
b. Industry approved practices
c. Maintenance schedules and specifications.

AC2.5 complete documented maintenance procedures on electrical circuits/systems

Assess five from the following:

a. Distribution systems
b. Low voltage circuits
c. Extra low voltage circuits
d. Lighting systems
e. Heating and ventilating systems
f. Air conditioning and refrigeration systems
g. Drive systems
h. Security systems
i. Earthing systems
j. Data communication/networking systems
k. Other circuit/system.

AC2.6 complete documented maintenance procedures on electrical equipment:

Assess five from the following:

a. Electrical plant, components and accessories
b. Motors
c. motor control equipment
d. Switchgear/distribution panels
e. Control systems/components
f. Contactors
g. Power transmission mechanisms
h. Luminaires/lamps
i. Other relevant equipment.

AC2.7 monitor the effectiveness of the maintenance activity against current industry best practice and technical principles

AC2.8 evaluate and apply the appropriate inspections, tests/checks to verify the maintenance work has been carried out in accordance with requirements

AC2.9 complete maintenance work in a professional manner - assess one:

a. Within the timescale agreed by the person ordering the work
b. Advising the relevant person/s about any anticipated delays or about any further repairs that need to be carried out.

AC2.10 complete maintenance records accurately and submit them to the relevant person/s

AC2.11 evaluate the effectiveness of the maintenance activity against current industry best practice and technical principles

AC2.12 make formal recommendations for the improvement of maintenance activities to the supervisor.

Unit 312/212 Inspection, Testing and Commissioning

Level:	3
GLH:	80
Assessment type:	Online multiple-choice test (212) and assignment comprising of practical assessment and theory-based written tasks (312)
Aim:	This unit is designed to enable learners to understand principles, practices and legislation for the initial verification and periodical inspection of electrical installations with statutory and non-statutory regulations and requirements. Its content is the knowledge needed by a learner to underpin the application of skills for the inspection, testing, commissioning and certification of electrical installations; and reporting of electrical installations, including the condition of existing systems.

Learning outcome

The learner will:

LO1 understand the requirements for completing the safe isolation of electrical circuits and installations

Assessment criteria

The learner can:

AC1.1 state the **requirements** of the Electricity at Work Regulations for the safe inspection of electrical systems and equipment
AC1.2 specify the appropriate **procedure** for completing safe isolation
AC1.3 state the **reasons** for carrying out safe isolation
AC1.4 state the **implications** of carrying out safe isolation
AC1.5 state the **implications** of not carrying out safe isolation
AC1.6 identify the **health and safety requirements** which apply when inspecting, testing and commissioning electrical installations and circuits

Range

Requirements:
In terms of:

- those carrying out the work
- those using the premises during the inspection.

Procedure:
Carrying out safe working practices:

- 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.

Reasons:
In relation to:

- The inspector
- Other personnel
- Customers/clients
- Public
- Building systems.

Implications:
In relation to:

- The inspector
- Other personnel
- Customers/clients
- Public
- Building systems (removal of supply).

Health and safety requirements:

- 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
- Detecting possible diverted neutral currents.

Learning outcome

The learner will:

LO2 understand the requirements for inspection of electrical installations

Assessment criteria

The learner can:

AC2.1 state the purpose of the **inspection** of electrical installations
AC2.2 state the requirements of the **inspection** identify the **relevant documents** associated with the inspection, testing commissioning and reporting of an electrical installation
AC2.3 specify the information that is required by the inspector to conduct the inspection

of an electrical installation

Range

Inspection

- Initial verification
- Periodic Inspection (including sampling, extent and limitations, condition report codes and situations requiring reporting)

Relevant documents:

- Electricity at Work Regulations
- BS 7671
- IET Guidance Note 3
- HSE Guidance.

Learning outcome

The learner will:

LO3 understand the requirements for completing the inspection of electrical installations prior to their being placed into service

Assessment criteria

The learner can:

AC3.1 select appropriate items to be checked during the inspection process
AC3.2 identify human senses appropriate for initial verification
AC3.3 state how the senses can be used during the inspection process
AC3.4 specify the **requirements for the inspection** of electrical installations
AC3.5 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:

LO4 understand the requirements for the safe testing and commissioning of electrical installations

Assessment criteria

The learner can:

AC4.1 state the tests to be carried out on an electrical installation in accordance with the BS 7671 and IET Guidance Note 3
AC4.2 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.
AC4.3 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.
AC4.4 explain why it is necessary for test results to comply with standard values
AC4.5 state the actions to be taken in the event of unsatisfactory results being obtained
AC4.6 explain why testing is carried out in the sequence specified in BS 7671 and IET Guidance Note 3

Learning outcome

The learner will:

LO5 understand the requirements for testing before circuits are energised

Assessment criteria

The learner can:

AC5.1 state why it is necessary to verify continuity to include:
  a. Protective bonding conductors
  b. Circuit protective conductors
  c. Ring final circuit conductors.
AC5.2 state the methods for verifying continuity to include:
  a. Protective conductors
  b. Ring final circuit conductors.
AC5.3 explain **factors that affect conductor resistance values**
AC5.4 specify the **procedures** for completing insulation resistance testing
AC5.5 state the effects on insulation resistance values that the following can have:
  a. Cables connected in parallel
  b. Variations in cable length.
AC5.6 explain why it is necessary to verify polarity
AC5.7 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:

LO6 understand the requirements for testing energised installations

Assessment criteria

The learner can:

AC6.1 state the procedures for confirming polarity of the incoming supply
AC6.2 specify the methods for measuring earth electrode resistance to include:
  a. Installations forming part of a TT system
  b. Generators and transformers.
AC6.3 describe **common earth fault loop paths**
AC6.4 state the **methods for verifying protection** by automatic disconnection of supply
AC6.5 identify the requirements for the measurement of prospective fault current
AC6.6 specify the **methods for determining** prospective **fault current**
AC6.7 verify the suitability of protective devices for prospective fault currents
AC6.8 specify the methods for testing the correct operation of residual current devices
AC6.9 state the reasons for verifying phase sequence
AC6.10 state the methods used to verify phase sequence
AC6.11 state the need for functional testing
AC6.12 identify items which require functional testing
AC6.13 state the appropriate **procedures for dealing with clients** during the commissioning and certification process

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

Methods 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:

LO7 understand the requirements for the completion of documentation

Assessment criteria

The learner can:

AC7.1 explain the purpose of certification and associated **documentation**
AC7.2 state the information that must be contained on **documentation**
AC7.3 describe the certification process for a completed installation
AC7.4 identify the responsibilities of different relevant personnel in relation to the completion of the certification process
AC7.5 explain the requirements for the recording and retention of completed documentation in accordance with the BS 7671

Range

Documentation:

- Electrical Installation Certificate
- Minor Electrical Installation Works Certificate
- Electrical Installation Condition Report
- Condition Report Inspection Schedule
- Schedule of Inspections
- Schedule of Test results
- Schedule of Circuit Details

Learning outcome

The learner will:

LO8 be able to confirm safety of system and equipment prior to completion of inspection, testing and commissioning

Assessment criteria

The learner can:

AC8.1 carry out safe isolation procedures in accordance with regulatory requirements
AC8.2 comply with the health and safety requirements of themselves and others within the work location during the initial verifications process
AC8.3 check the safety of electrical systems prior to the commencement of inspection, testing and commissioning

Learning outcome

The learner will:

LO9 Be able to carry out inspection of electrical installations prior to them being placed into service

Assessment criteria

The learner can:

AC9.1 identify a safe system of work appropriate to the work activity
AC9.2 carry out an initial inspection of an electrical installation in accordance with the requirements of BS 7671 and IET Guidance Note 3
AC9.3 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:

LO10 Be able to test electrical installations prior to them being placed into service

Assessment criteria

The learner can:

AC10.1 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.

AC10.2 evaluate the appropriate tests suitable for the installation to be verified

AC10.3 carry out tests in accordance with BS 7671, IET On-site Guide and Guidance Note 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 (Ze)
e. System earth fault loop impedance (Zs)
f. Prospective fault current
g. RCD operation including additional protection
h. Phase sequence

i. Functional testing.

2. confirm compliance by evaluating and verifying test results
3. 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:

LO11 be able to commission electrical systems and equipment

Assessment criteria

The learner can:

AC11.1 clarify the commissioning procedures with relevant persons
AC11.2 carry out the commissioning of circuits, accessories and equipment to confirm functionality

Unit 113 Inspect, Test and Commission Electrical Systems

Level:	3
GLH:	16
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to inspect, test, commission and certify electrical systems and equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome

The learner will:

LO1 Be able to confirm safety of the system and equipment prior to completion of inspection, testing and commissioning in accordance with statutory and non-statutory regulations

Assessment criteria

The learner can:

AC1.1 carry out safe isolation procedures in accordance with regulatory requirements for electrical installations

AC1.2 ensure the health and safety of themselves and others within the work location during inspection, testing and commissioning

AC1.3 check the safety of electrical systems prior to the commencement of inspection, testing and commissioning

Learning outcome

The learner will:

LO2 be able to inspect electrical systems and equipment

Assessment criteria

The learner can:

AC2.1 assess whether the safe system of work is appropriate to the work activity
AC2.2 carry out a visual inspection in accordance with the requirements of the installation specification, BS 7671 and IET Guidance Note 3
AC2.3 complete a schedule of inspections in accordance with the BS 7671 and IET Guidance Note 3 making technical decisions.

Learning outcome

The learner will:

LO3 be able to test and commission electrical systems and equipment

Assessment criteria

The learner can:

AC3.1 select the correct test instruments and their accessories for tests
AC3.2 carry out **tests** in accordance with the installation specification and BS 7671and manufacturer's instructions
AC3.3 analyse and verify test results reporting all findings to **relevant persons**, as appropriate
AC3.4 complete in accordance with BS 7671 and IET Guidance Note 3:
  a. Electrical installation certificates:
    i. Schedules of inspections
    ii. Schedules of test results
  b. Minor electrical installation works certificates
AC3.5 complete the handover of electrical systems and equipment to relevant persons including the provision of accurate and completed documentation regarding the completed inspection, testing, commissioning and customer satisfaction.
AC3.6 demonstrate to the customer/client that the operation of the circuits, equipment and components are in accordance with the installation specification and customer/client requirements

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Range

Tests:

- Continuity
- Insulation resistance
- Polarity
- Earth fault loop impedance/earth electrode
- Prospective fault current
- RCD operation
- Functional testing

Relevant persons:

- Representatives of other services/colleagues
- Customers/clients

Unit 113 Inspect, Test and Commission Electrical Systems

Supporting Information

Notes for guidance

Prior to undertaking this unit a learner must provide auditable evidence that they have the relevant knowledge and understanding as detailed in the units:

- 312 Inspection, testing and commissioning
- 104 Understand design and installation practices and procedures.

Evidence requirements

Learning Outcome 1:

- Authorised confirmation that the learner has had involvement and experience in safe- isolation procedures as relevant on two separate occasions.
- Auditable evidence must be provided that the learner has demonstrated that they have competently undertaken a risk assessment on two separate occasions.

Learning Outcomes 2 to 3 – Auditable evidence sourced from a real working environment must be provided to illustrate that, the learner has demonstrated on two separate occasions they can apply the principles and follow the procedures for the inspecting, testing, commissioning and certifying of electrical systems and equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations and the assessment criteria for each of the learning outcomes.

In the delivery of this unit an 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 114/014 Understand Fault Diagnosis and Rectification

Level:	3
GLH:	32
Assessment type:	Online multiple-choice question test (014) and practical assignment (114)
Aim:	This unit is designed to enable learners to understand principles, practices and legislation associated with diagnosing and correcting electrical faults in electrical systems and equipment in buildings, structures and the environment in accordance with statutory and non-statutory regulations and requirements. Its content is the knowledge needed by a learner to underpin the application of skills used for fault diagnosis and correction in electrical systems and equipment in buildings, structures and the environment.

Learning outcome:

The learner will:

LO1 understand the health and safety requirements relevant to fault diagnosis

Assessment criteria

The learner can:

AC1.1 state the dangers of electricity in relation to fault diagnosis work
AC1.2 identify the **health and safety requirements** relevant to diagnosing and correcting electrical faults in electrical systems and equipment
AC1.3 specify **safe working procedures** that should be adopted for completion of fault diagnosis and correction work.

Range

Health and safety requirements

- 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

Safe working procedures

- 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

The learner will:

LO2 understand the importance of reporting and communication in fault diagnosis

Assessment criteria

The learner can:

AC2.1 describe the documentation relevant to fault diagnosis
AC2.2 state the **implications** of the fault diagnosis for customers and clients
AC2.3 explain the **communication requirements** relevant to fault diagnosis

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Range

Implications

- Loss of circuits
- Equipment

Communication requirements

- 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:
    - Other workers/colleagues
    - Customers/clients
    - Representatives of other services

Learning outcome

The learner will:

LO3 understand the nature and characteristics of electrical faults

Assessment criteria

The learner can:

AC3.1 identify types, causes and consequences of **electrical faults**
AC3.2 describe typical types of faults and their likely **locations in wiring systems** and equipment

---

Range

Electrical faults

- Loss of supply
- Low voltage/voltage drop
- Component/equipment malfunction/failure
- Operation of overload or fault current device
- Arcing parallel and series arcs or operation of AFDD
- High resistance - loose connection
- Transient voltages - lighting strike
- Excess current - overload
- Insulation failure - deterioration, mechanical damage
    - Short-circuit
    - Open Circuit
    - Earth fault
- Signal faults
- EMI.

Locations in wiring systems

- Wiring systems
- Terminations and connections
- Equipment/accessories (switches, luminaires, switchgear and control equipment)
- Instrumentation/metering.

Learning outcome

The learner will:

LO4 understand the fault diagnosis procedure

Assessment criteria

The learner can:

AC4.1 state precautions that must be taken when carrying out fault diagnosis with regard to **particular locations, equipment and circumstances**
AC4.2 explain the **logical stages** of fault diagnosis
AC4.3 select the appropriate **test instrument/s** for fault diagnosis work
AC4.4 describe how **test instruments** are confirmed to be fit for purpose and functioning correctly
AC4.5 specify an appropriate and logical procedures for carrying out fault diagnosis **tests**
AC4.6 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

All live 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:

LO5 understand the procedures and techniques for correcting electrical faults

Assessment criteria

The learner can:

AC5.1 identify **factors** which can affect repair or replacement of equipment
AC5.2 specify the procedures for **verifying** that the fault has been corrected suitable for the situation using technical analysis

AC5.3 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

Factors:

- 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).

Verifying:

- 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:

LO6 perform fault diagnosis

Assessment criteria

The learner can:

AC6.1 follow safe working procedures
AC6.2 evaluate and apply appropriate fault diagnosis **methods** and techniques
AC6.3 diagnose electrical faults using engineering decision and evaluation of symptoms and findings
AC6.4 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 115 Apply Fault Diagnosis and Rectification

Level:	3
GLH:	10
Assessment type:	Portfolio of evidence
Aim:	This unit is designed to enable the learner to develop the skills required, and apply the associated knowledge, in order that they are able to demonstrate the competence required to diagnose and correct electrical faults in electrical systems and equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations: • The Electricity at Work Regulations (1989) • The current edition of BS 7671 • Health & Safety Act (1974) • Building Regulations (2000)

Learning outcome

The learner will:

LO1 prepare to carry out fault diagnosis

Assessment criteria

The learner can:

AC1.1 check it is safe to carry out fault diagnosis
AC1.2 inform the relevant personnel of the fault diagnosis work (such as personnel on the premises, users of electrical equipment)
AC1.3 carry out the safe isolation procedure
AC1.4 evaluate and apply appropriate methods to ensure the safety of themselves and others when diagnosing and correcting electrical faults

Learning outcome

The learner will:

LO2 carry out fault diagnosis

Assessment criteria

The learner can:

AC2.1 communicate effectively with relevant personnel (eg. customer, premises manager) to ascertain the nature of the fault.

AC2.2 select and interpret appropriate documents (eg. layout drawings, schematic diagrams etc) which relate to the electrical systems and equipment being worked upon

AC2.3 assess and communicate potential disruption that may be a consequence of fault diagnosis and correction work to relevant people, such as:

a. Other workers/colleagues
b. Customers/clients.

AC2.4 carry out relevant inspections of electrical equipment analysing findings

AC2.5 confirm test instruments are fit for purpose, functioning correctly and are correctly calibrated

AC2.6 perform suitable diagnostic tests, based on engineering decision, to identify electrical faults

Assess three from the following:

a. Loss of supply
b. Overload
c. Short-circuit
d. Earth fault
e. Incorrect phase rotation
f. High resistance joints/loose terminations
g. Component, accessory or equipment faults
h. Open circuit
i. Signal faults.

AC2.7 use appropriate methods for locating faults including:

a. Using a logical approach
b. Using safe working practices
c. Interpretation of test readings.

AC2.8 use appropriate instruments correctly to carry out fault diagnosis

Assess three of the following:

a. Voltage indicator
b. Low resistance ohm meter
c. Insulation resistance tester
d. EFLI and PFC tester
e. RCD tester
f. Ammeter
g. Phase rotation tester
h. Other appropriate instrument.

Learning outcome

The learner will:

LO3 carry out fault rectification

Assessment criteria

The learner can:

AC3.1 assess the appropriate repairs, removals and replacements and their implications with relevant people including: One of the following:

a. Other workers/colleagues
b. Customers/clients.

AC3.2 perform fault correction procedures correctly and safely using appropriate tools, equipment and material

AC3.3 assess and verify that replacement components and associated equipment maintain:

a. Ease of access to enable future maintenance
b. compliance with relevant regulations
c. compliance with manufacturer's instructions/ organisational procedures.

AC3.4 apply appropriate procedures to ensure electrical equipment and components are left safe, in accordance with industry regulations, if the fault cannot be corrected immediately based on technical assessment.

AC3.5 establish and perform an appropriate inspection and testing procedure to confirm that circuits/equipment/components are functioning correctly after completion of fault correction work

AC3.6 record test results and other appropriate information regarding the fault correction work clearly and accurately and report it to relevant people.

Assess one of the following:

a. Other workers/colleagues
b. Customers/clients
c. Representatives of other services.

Unit 022 Understand the Requirements of Electrical Installations BS 7671:2018 (2022)

Level:	3
GLH:	70
Assessment type:	Online multiple-choice question test
Aim:	This unit gives the learner an understanding of the full content of BS6761, and how this applies to electrical installations within its scope.

Learning outcome
The learner will:

LO1 understand the scope, object and fundamental principles of BS 7671.

Assessment criteria
The learner can:

AC1.1 identify the scope of BS 7671
AC1.2 identify the object of BS 7671
AC1.3 identify the fundamental principles of BS 7671.

Learning outcome
The learner will:

LO2 understand the definitions used within BS 7671.

Assessment criteria
The learner can:

AC2.1 interpret the definitions used within BS 7671
AC2.2 relate the definitions to the regulations and appendices of BS 7671.

Learning outcome
The learner will:

LO3 understand how to assess the general characteristics of electrical installations.

Assessment criteria
The learner can:

AC3.1 interpret the requirements of assessing the general characteristics of electrical installations within the scope of BS 7671 including;

- Chapter 31 Purpose, supplies and structure
- Chapter 32 Classification of external influences
- Chapter 33 Compatibility
- Chapter 34 Maintainability
- Chapter 35 Safety services
- Chapter 36 Continuity of service.

Learning outcome
The learner will:

LO4 understand requirements of protection for safety for electrical installations.

Assessment criteria
The learner can:

AC4.1 identify the requirements of protection for safety within the scope of BS 7671 including:

- Chapter 41 Electric shock
- Chapter 42 Thermal effects
- Chapter 43 Overcurrent
- Chapter 44 Voltage disturbances and EMI
- Chapter 46 Isolation and switching.

AC4.2 interpret how this applies to electrical installations within the scope of BS 7671 to include:

- Protection against electric shock
- Protection against thermal effects
- Protection against overcurrent
- Protection against voltage disturbances and electromagnetic disturbances
- Isolation and switching.

Learning outcome
The learner will:

LO5 understand the requirements for selection and erection of equipment for electrical installations.

Assessment criteria
The learner can:

AC5.1 identify the requirements for selecting and erecting equipment and interpret how this applies to wiring systems

AC5.2 interpret how this applies to electrical installations within the scope of BS 7671 to include:

- Common rules
- Wiring systems
- Protection, isolation, switching, control and monitoring
- Earthing arrangements and protective conductors
- Other equipment
- Safety services

Learning outcome
The learner will:

LO6 understand the requirements of inspection and testing of electrical installations.

Assessment criteria
The learner can:

AC6.1 identify the requirements for inspection and testing
AC6.2 interpret how this applies to electrical installations including;

- Chapter 64 Initial verification
- Chapter 65 Periodic inspection and testing

Learning outcome
The learner will:

LO7 understand the requirements of special installations or locations as identified in BS 7671

Assessment criteria
The learner can:

AC7.1 identify the requirements for special installations including;

- Section 700 General
- Section 701 Locations containing a bath or shower
- Section 702 Swimming pools and other basins
- Section 703 Rooms and cabins containing sauna heaters
- Section 704 Construction and demolition site installations
- Section 705 Agricultural and horticultural premises
- Section 706 Conducting locations with restricted movement
- Section 708 Electrical installations in caravan / camping parks and similar locations

- Section 709 Marinas and similar locations
- Section 710 Medical locations
- Section 711 Exhibitions, shows and stands
- Section 712 Solar photovoltaic (PV) power supply systems
- Section 714 Outdoor lighting installations
- Section 715 Extra-low voltage lighting installations
- Section 717 Mobile or transportable units
- Section 721 Electrical installations in caravans and motor caravans
- Section 722 Electric vehicle charging installations
- Section 729 Operating and maintenance gangways
- Section 730 Onshore units of electrical connections for inland navigation vessels
- Section 740 Temporary electrical installations for structures, amusement devices and booths at fairgrounds, amusement parks and circuses
- Section 753 Heating cables and embedded heating systems

AC7.2 interpret how these affect the general requirements of the regulations.

Learning outcome

The learner will:

LO8 Understand the information contained within Part 8 and the appendices of BS 7671.

Assessment criteria

The learner can:

AC8.1 identify the information contained in Part 8 of BS 7671

AC8.2 identify the information in the appendices of BS 7671

AC8.3 specify how the information contained in the appendices is used to support electrical installation activities.

Appendix 1 Relationships to other qualifications

Links to other qualifications

This qualification has connections to the following within the electrical suite offered by City & Guilds:

- 2382
- 2391

Upon achievement of the 5357-23 or 5357-94 (unit route) learners are able to apply for additional certification.

2382 Requirements for Electrical Installations

To gain certification for **Level 3 Award in the Requirements for Electrical Installations BS 7671:2018 (2022**), learners must have achieved the assessment 5357-022 and have been certificated against 5357-23/94. Centres can then register learners onto the 2382-82 and claim the certification module 2382-923 which will generate this certificate.

2391 Electrical Inspection and Testing

To gain certification for Level 3 Award in Initial Verification of Electrical Installations, learners must have achieved the assessments 5357-312, 5357-212 and have been certificated against 5357-23/94.

Centres can then register learners onto 2391-71 and claim the certification module 2391- 902 which will generate this certificate.

Appendix 2 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 **www.cityandguilds.com** or click on the links below:

Centre Handbook: Quality Assurance Standards
This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on:

- centre quality assurance criteria and monitoring activities
- administration and assessment systems
- centre-facing support teams at City & Guilds/ILM
- centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the centre contract.

Centre Handbook: Quality Assurance Standards
This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre-assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre assessments.

Access arrangements: When and how applications need to be made to City & Guilds 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 document library** also contains useful information on such things as:

- conducting examinations
- registering learners
- appeals and malpractice.

Useful contacts

Please visit the **contact us** section of the City & Guilds website.

City & Guilds

For almost 150 years, we have worked with people, organisations and economies to help them identify and develop the skills they need to thrive. We understand the life-changing link between skills development, social mobility, prosperity and success. Everything we do is focused on developing and delivering high-quality training, qualifications, assessments and credentials that lead to jobs and meet the changing needs of industry.

We partner with our customers to deliver work-based learning programmes that build competency to support better prospects for people, organisations and wider society. We create flexible learning pathways that support lifelong employability because we believe that people deserve the opportunity to (re)train and (re)learn again and again – gaining new skills at every stage of life, regardless of where they start.

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