

City & Guilds Level 3 Electrotechnical in Dwellings (5393-03)

Version 1.2 (March 2023)

Qualification Handbook

Qualification at a glance

| | |
|---------------------------------------|---|
| Subject area | Building Services Engineering |
| City & Guilds number | 5393-03 |
| Age group approved | 16+ |
| 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 | Multiple-choice tests / Short answer test / Assignments / Portfolio of evidence |
| Grading | Pass |
| Approvals | Fast track approval / Full approval required for new centres |
| Support materials | Logbook, Sample assessments, Smartscreen |
| 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 in Dwellings | 5393-03 | 610/1297/X | 650 | 743 |

| Version and date | Change detail | Section |
|--------------------|--|--|
| 1.0 September 2022 | Initial version | All |
| 1.1 October 2022 | Information on direct observation requirements updated | 4. Assessment – Assessment strategy – Table A, Unit 102 - Supporting information |
| | Repeated information on evidence sources deleted | 4. Assessment – Evidence sources |
| | KSB mapping updated | Unit 106 – Supporting information |
| 1.2 March 2023 | Evidence requirements updated for Learning outcome 6 | Unit 109 – supporting information |

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1 Introduction

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

| Area | Description |
|--|---|
| Who is the qualification for? | This Electrotechnical in Dwellings qualification meets the needs of Apprentices in England who want to work as a Domestic Electrician, installing and maintaining systems and equipment, including the connection of a range of comfort and convenience devices, in a range of domestic settings such as homes, dwellings or individual units eg care homes. It is a mandatory requirement of the Domestic Electrician apprenticeship framework in England. This qualification is for apprentices only. |
| What does the qualification(s) cover? | This qualification covers the knowledge, skills and competency required by a Domestic Electrician including the design, installation and testing of systems which provide heating, power and lighting, plus the installation of new and emerging technologies. |
| What opportunities for progression are there? | This qualification will enable learners to work for small independent business or providers of homes such as local authorities, housing construction or electric utility companies. Once qualified they may wish to be become self-employed contractors or progress to become fully qualified Industrial or Commercial Electricians. |
| Who did we develop the qualification with? | This qualification has been developed in conjunction with a wider employer group who set the apprenticeship standard from which the qualification was derived such as: Centrica, Arena Electrical Services, She's Electric, Lincolnshire Housing Partnership and N-R-T Building Group Services. |
| Is it part of an apprenticeship framework or initiative? | England Apprenticeship framework for Domestic Electrician. This qualification is for Apprentices only. |

Structure

To achieve the City & Guilds Level 3 Electrotechnical in Dwellings learners must achieve:

| City & Guilds unit number | Unit title | GLH |
|--|---|-----|
| Mandatory units: | | |
| Learners must achieve all 12 mandatory units and related assessments. | | |
| 101 | Health, safety and environmental considerations in dwellings | 42 |
| 102 | Apply health, safety and environmental considerations in dwellings | 10 |
| 103 | Electrical scientific principles and technologies for work in dwellings | 110 |
| 104 | Design and installation practices and procedures for dwellings and associated buildings | 208 |
| 105 | Practices and procedures for planning and overseeing electrical work activities in dwellings | 30 |
| 106 | Plan and oversee the electrical work activities in dwellings | 12 |
| 109 | Apply design and installation practices including termination and connection of conductors in dwellings | 35 |
| 112 | Practices and procedures for inspection, testing and commissioning in dwellings | 82 |
| 113 | Inspect, test, report and commission electrical systems in dwellings | 12 |
| 114 | Practices and procedures for fault diagnosis and rectification in dwellings | 29 |
| 115 | Apply fault diagnosis and rectification in dwellings | 10 |
| 022 | Understand the Requirements for Electrical Installations BS 7671:2018 (2022) | 70 |

Total Qualification Time

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 is comprised of the following two elements:

- 1) The number of hours that an awarding organisation has assigned to a qualification for Guided Learning, and
- 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 in Dwellings | 650 | 743 |

2 Centre requirements

Approval

Fast track approval

If your centre is approved to offer the 5357-03 then you can apply for fast track approval for the new 5393-03/93 using the fast track approval form, available from the City & Guilds website.

Centres should use the fast track form if:

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

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

Please refer to the document **Quality Assurance Standards: Centre Approval Process** for further information.

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

Resource requirements

Centre staffing

See the assessment strategy below on the role of all personnel involved in the assessment process.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

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. For more detail on this visit the [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.

See the assessment strategy below on the role of all personnel involved in the assessment process.

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 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 these qualifications. However, centres must ensure that learners have the potential and opportunity to gain the qualification successfully. It is also 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 to assessment and special consideration

For information on how to apply for access arrangements please refer to ***How and when to apply for access arrangements and special consideration (cityandguilds.com)***

3 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.

Support materials

The following resources are available for this qualification:

| Description | How to access |
|--------------------------------|--|
| Fast track approval form | www.cityandguilds.com |
| Sample assessments | www.cityandguilds.com |
| Assessor guidance | www.cityandguilds.com |
| Candidate/question paper packs | www.cityandguilds.com |
| Candidate logbook | www.cityandguilds.com |
| SmartScreen | www.smartscreen.co.uk |

4 Assessment

Assessment of the qualification

The qualification is assessed through a variety of assessment methods. Units 101, 103, 104, 105, 122, 114 and 022 include:

- online multiple-choice tests (externally set and marked)
- short-answer question paper (externally set and internally marked)
- project and assignments (externally set and internally marked)
- practical observation (externally set and internally marked)

These units will be assessed at the candidate's training provider and centres should refer to assessor guidance for rules on assessment conditions.

The performance units (102, 106, 109, 113 and 115) will be evidenced through a work place evidence record which will form part of the candidate's portfolio. The performance units should be assessed through naturally occurring opportunities whilst in the work place. The work place evidence record allows candidates to demonstrate the practical skills and associated knowledge required of a domestic electrical apprentice.

Candidates must:

- successfully complete all assessments for units 101, 103, 104, 105, 112, 114 and 022
- have a completed portfolio of evidence for units 102, 106, 109, 113 and 115.

Assessment Types

| Unit | Title | Assessment method | Where to obtain assessment materials |
|-------------|--|--|--|
| 101 | Health, safety and environmental considerations in dwellings | Assignment | Candidate pack - www.cityandguilds.com |
| 001 | | Online multiple-choice test | City & Guilds e-volve system |
| 102 | Apply health, safety and environmental considerations in dwellings | Portfolio of evidence Centres may use the workplace logbook provided by City & Guilds, or develop their own (subject to EQA approval) | www.cityandguilds.com |
| 103 | Electrical scientific principles and technologies for work in dwellings | Short answer test | Question paper pack - www.cityandguilds.com |
| 003 | | Online multiple-choice test | City & Guilds e-volve system |
| 104/ 204 | Design and installation practices and procedures for dwellings and associated buildings | Project Assignment | Candidate pack - www.cityandguilds.com |
| 004 | | Online multiple-choice test | City & Guilds e-volve system |
| 105 | Practices and procedures for planning and overseeing electrical work activities in dwellings | Assignment | Candidate pack - www.cityandguilds.com |

| | | | |
|-----|---|--|---|
| 106 | Plan and oversee the electrical work activities in dwellings | Portfolio of evidence Centres may use the workplace logbook provided by City & Guilds, or develop their own (subject to EQA approval) | www.cityandguilds.com |
| 109 | Apply design and installation practices including termination and connection of conductors in dwellings | Portfolio of evidence Centres may use the workplace logbook provided by City & Guilds, or develop their own (subject to EQA approval) | www.cityandguilds.com |
| 112 | Practices and procedures for inspection, testing and commissioning in dwellings | Assignment | Candidate pack - www.cityandguilds.com |
| 012 | | Online multiple-choice test | City & Guilds e-volve system |
| 113 | Inspect, test, report and commission electrical systems in dwellings | Portfolio of evidence Centres may use the workplace logbook provided by City & Guilds, or develop their own (subject to EQA approval) | www.cityandguilds.com |
| 114 | Practices and procedures for fault diagnosis and rectification in dwellings | Assignment | Candidate pack - www.cityandguilds.com |
| 014 | | Online multiple-choice test | City & Guilds e-volve system |
| 115 | Apply fault diagnosis and rectification in dwellings | Portfolio of evidence Centres may use the workplace logbook provided by City & Guilds, or develop their own (subject to EQA approval) | www.cityandguilds.com |

| | | | |
|-----|--|-----------------------------|------------------------------|
| 022 | Understand the Requirements for Electrical Installations BS 7671:2018 (2022) | Online multiple-choice test | City & Guilds e-volve system |
|-----|--|-----------------------------|------------------------------|

Assessment strategy

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 candidates who successfully complete both the assignment (101) and the e-volve test (001), and are a registered apprentice with the JIB, 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 their apprentice.

Performance units (102, 106, 109, 113 and 115)

These units may be assessed using the following methods unless specified in Table A below. Where a minimum quantity of range is required to satisfy any performance criteria, this will be specified within the unit criteria. Any criteria which has a range labelled a, b, c etc is mandatory.

Evidence that is sourced from the real working environment for Performance Units must be naturally occurring, assessed on a minimum of **two** occasions and can be generated by:

- 1) Direct observation of performance in the workplace by a qualified assessor and/or testimony from an expert witness subject to the activity being assessed (see Expert Witness requirements below). This will be the preferred source of evidence.

Or

- 2) Candidate's reflective account of performance **and** work plans / approved work based products eg risk assessment documentation, method statements, diagrams, drawings, specifications, customer testimony, authorised and authenticated photographs/images and audio visual records of work completed together with candidate questioning.

Or

- 3) Evidence from prior achievements that demonstrably match the requirements of the Performance Unit.

Or

- 4) Witness testimony only (see Expert Witness requirements below).

Simulated assessment is **not** permitted.

Apprentices must be adequately supervised in the workplace in accordance with relevant legislation. This is particularly important when working toward the performance units when working at heights, inspecting and testing, and diagnosing faults.

Table A

| Unit no | Unit title | |
|---------|---|---|
| 102 | Apply health, safety and environmental considerations in dwellings | <p>This unit 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 approved work-based products which is provided by the employer.</p> <p>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.</p> <p>On both occasions this should be fully documented and made available for quality assurance.</p> |
| 106 | Plan and oversee the electrical work activities in dwellings | All other performance criteria must be met on two separate occasions on two individual and independent work sites. Where range exists, alphabetical ranges must be fully met. |
| 109 | Apply design and installation practices including termination and connection of conductors in dwellings | Bulleted ranges must be met, as a minimum , the number of range items indicated within each learning outcome or assessment criteria, see unit evidence requirements . As an example, if two ranges are indicated as a minimum, this may be two items on two occasions each, or four items on one occasion each or one item twice and two items once. |
| 113 | Inspect, test, report and commission electrical systems in dwellings | |
| 115 | Apply fault diagnosis and rectification in dwellings | |

Requirements of Assessors, Internal Quality Assurers, Expert Witnesses and Delivery Personnel

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.

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 City & Guilds.

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 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 through a CV, JIB grading at an appropriate grade, membership of an institution eg EngTech, MEIT.

All teachers/instructors must hold (or be working towards) a recognised teaching qualification (to a minimum of L3 standard) such as the Level 3 Award in Education and Training.

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.

Portfolio of evidence

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 learners' progress towards achieving qualifications. Further details are available at www.cityandguilds.com/eportfolios.

City & Guilds has developed a logbook specifically designed to meet the needs of candidates and assessor this qualification. This is available on the 5393 qualification page on the City & Guilds website.

Although new centres are expected to use this logbook, centres may devise or customise their own recording forms, which must be approved for use by the External Quality Assurer, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of recording forms are available on the City & Guilds website.

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 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.

Important note: AM2D

This handbook contains all the assessment information needed to pass all the units within this qualification. However for the candidate to achieve the **apprenticeship in England**, they also need to successfully complete the End Point Assessment (AM2D) provided by NET. No assessment in this qualification will contribute to the overall grade of the apprenticeship in England which is determined solely by the End Point Assessment (AM2D).

The AM2D is a robust, timed EPA (22 hours typically over 3 and a half days) consisting of a practical domestic type installation, scenario based technical interview, and theory (40 multiple-choice questions) assessments. All the assessments require candidates to perform a set of common tasks and procedures that a Domestic Electrician may face when working in a domestic environment. It assesses candidates on installation work, inspection and testing, fault-finding and condition reporting. Their work must comply with the current BS 7671, be in line with relevant Health and Safety legislation and conform to current industry practices and procedures. The Scenario based interview will cover areas that the candidates may encounter when dealing with customers and clients, or situations that may occur during any installation work that is likely to be carried out in a Domestic environment. The online theory assessment will cover aspects of appropriate building regulations, health and safety, applicable wiring regulations and installation knowledge.

The End Point Assessment (AM2D) will be graded fail/pass/distinction.

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.

Test specifications

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

Grade boundaries may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

| 5393-001 Health, safety and environmental considerations in dwellings | | |
|---|----------------------------|-----------------|
| Outcome | Number of questions | Approx % |
| 1 Know how relevant legislation applies in the workplace | 5 | 20% |
| 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 | 8 | 32% |
| 4 Understand the requirements for identifying and dealing with hazards in the work environment | 6 | 24% |
| Total | 25 | 100% |

Duration: 40 mins

Graded: Pass/Fail

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

Permitted material: Non-programmable scientific calculator

| 5393-003 Electrical scientific principles and technologies for work in dwellings | | |
|--|----------------------------|-----------------|
| Outcome | Number of questions | Approx % |
| 1 Understand mathematical principles and SI units | 7 | 18% |
| 2 Understand mechanical principles | 7 | 17% |
| 3 Understand the relationship between resistance, resistivity, voltage, current and power | 12 | 30% |
| 4 Understand the relationship between magnetism and electricity | 10 | 25% |
| 5 Understand the types, applications, and limitations of electrical and electronic equipment | 4 | 10% |
| Total | 40 | 100% |

Duration: 90 mins

Graded: Pass/Merit/Distinction

Grade boundaries: The grade boundaries for this test will be approximately:

Pass: 50%

Merit: 65%

Distinction: 80%

Resit: Capped at Pass only 50%

Permitted material: Non-programmable scientific calculator

5393-103 Electrical scientific principles and technologies for work in dwellings

| Outcome | Number of questions | Approx % |
|---|---------------------|-------------|
| 6 Understand electrical supply systems | 8 | 30% |
| 7 Understand AC electrical properties | 9 | 34% |
| 8 Understand the operating principles of electrical components | 3 | 12% |
| 9 Understand the principles and applications of electrical lighting systems | 3 | 12% |
| 10 Understand the principles and applications of heating systems | 3 | 12% |
| Total | 26 | 100% |

Duration: 120 mins

Graded: Pass/Merit/Distinction

Grade boundaries: The grade boundaries for this test will be approximately:

Pass: 50%

Merit: 65%

Distinction: 80%

Resit: Capped at Pass only 50%

Permitted material: Non-programmable scientific calculator

5393-004 Design and installation practices and procedures for dwellings and associated buildings

| Outcome | Number of questions | Approx % |
|---|--------------------------|-------------|
| 1 Know the documents affecting electrical design | 3 | 7% |
| 2 Understand the applications of wiring systems common in dwellings | 11 | 24% |
| 3 Understand the practices and procedures for carrying out electrical work | 11 | 24% |
| 4 Understand the characteristics and applications of supply systems and consumer's equipment | 3 | 7% |
| 5 Understand the requirements and measures for protection against electric shock | 3 | 7% |
| 6 Understand protection against overcurrent | 5 | 11% |
| 7 Understand electrical systems and circuits | 4 | 9% |
| 8 Understand electrical accessibility aids and accessibility requirements | Assessed by other method | |
| 9 Understand methods of terminating, connecting and supporting conductors and cables in electrical wiring systems and equipment | 5 | 11% |
| Total | 45 | 100% |

Duration: 90 mins

Graded: Pass/Fail

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

Permitted material: IET On-Site Guide; IET Electrician's Guide to the Building Regulations; Non-programmable scientific calculator

5393-012 Practices and procedures for inspection, testing and commissioning in dwellings

| Outcome | Number of questions | Approx % |
|---|--------------------------|-------------|
| 1 Understand the requirements for completing the safe isolation of single-phase electrical circuits and installations | 7 | 18% |
| 2 Understand the requirements for initial verification of single-phase electrical installations in dwellings | 3 | 8% |
| 3 Understand the requirements for completing the inspection of single-phase electrical installations in dwellings, prior to their being placed into service | Assessed by other method | |
| 4 Understand the requirements for the safe testing and commissioning of single-phase electrical installations in dwellings | 9 | 22% |
| 5 Understand the requirements for testing before circuits are energised | 9 | 22% |
| 6 Understand the requirements for testing energised single-phase installations | 10 | 25% |
| 7 Understand the requirements for the completion of electrical installation certificates and associated documentation | 2 | 5% |
| Total | 40 | 100% |

Duration: 90 mins

Graded: Pass/Fail

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

Permitted material: Non-programmable scientific calculator

5393-014 Practices and procedures for fault diagnosis and rectification in dwellings

| Outcome | Number of questions | Approx % |
|---|---------------------|-------------|
| 1 Understand the importance of reporting and communication during fault diagnosis work in dwellings | 4 | 13% |
| 2 Understand the nature and characteristics of electrical faults in dwellings | 7 | 23% |
| 3 Understand the fault diagnosis procedure for single-phase electrical systems | 10 | 33% |
| 4 Understand the procedures and techniques for correcting electrical faults in dwellings | 9 | 31% |
| Total | 30 | 100% |

Duration: 60 mins

Graded: Pass/Fail

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

Permitted material: Non-programmable scientific calculator

5393-022 Understand the Requirements for Electrical Installations BS 7671:2018 (2022)

| Outcome | Number of questions | Approx % |
|--|----------------------------|-----------------|
| 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% |

Duration: 120 mins

Graded: 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; Non-programmable scientific calculator

5 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
- Supporting information
- Relationship to apprenticeship standards.

Guidance for delivery of the units

This qualification is comprised of a number of **units**. A unit describes what is expected of a competent person in particular aspects of his/her 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** (skills, performance, 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

Health, safety and environmental considerations in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 42 |
| Assessment type: | Online multiple-choice test (closed book) Assignment (closed book) |
| Aim: | This unit will enable learners to understand the relevant legislation, practices and procedures when installing and maintaining electrical systems and equipment in dwellings. Learners will develop the knowledge and skills needed for the safe and legal planning and working in dwellings. |

Learning outcome

The learner will:

LO1 know 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 current **relevant environmental legislation**

Range

AC1.1

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

AC1.2 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 specify **appropriate responsible persons** to whom Health and Safety and welfare related matters should be reported

AC2.4 state **how the environment may be affected by work activities**

AC2.5 specify the current **requirements and good working practices** for processing waste on site

AC2.6 explain the importance of reporting hazards to the environment that arise from work procedures

Range

AC2.2 Appropriate procedures

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

- Application of first aid
- RIDDOR reporting procedure

AC2.2 **Appropriate responsible persons**

- Employer
- Employees
- Customer/client
- Safety officers
- Health & Safety executive/inspectors
- Trades union representative
- Environmental health officers

AC2.3 **Effect of work activities**

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

AC2.4 **Requirements and good working practices**

- Recycling
- Hazardous waste
- Landfill

Learning outcome

The learner will:

LO3 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 procedures for working around vulnerable persons
- AC3.3 describe procedures for reporting safeguarding concerns
- AC3.4 state procedures for protecting customers and others during work activities in dwellings
- AC3.5 state how pets may disrupt work activities and how they need to be considered when preparing the workplace
- AC3.6 describe the procedures that should be taken to remove or minimise risks
- AC3.7 state the purpose of PPE and protective clothing
- AC3.8 state the first aid facilities that must be available and maintained for lone workers and housing development sites
- AC3.9 describe safe practices and **procedures** for the use of **equipment and materials** in the working environment
- AC3.10 specify the procedures for ensuring **electrical systems** are safe to work on (safe isolation procedure)
- AC3.11 state the **implications** of:
 - a. carrying out safe isolation procedures

- b. not carrying out safe isolation procedures

Range

AC3.9

Procedures

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

Equipment and materials

- Manual handling techniques
- Powered access equipment (PASMA requirements)
- Ladders
- Use of mobile scaffold towers
- Portable power and hand tools
- Dangerous substances
- Use of signs and guarding

AC3.10 Electrical systems

- Single and three-phase supplies
- Single and three-phase circuits
- Single-phase equipment

AC3.11 Implications

- Self
- Others
- 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 packaging warning signs
- AC4.2 describe situations that can lead to danger when working in occupied dwellings
- AC4.3 describe **situations** which can constitute a hazard on site
- AC4.4 identify the correct type of fire extinguisher for a particular type of fire
- AC4.5 explain situations **where asbestos may be encountered** in dwellings
- AC4.6 specify the procedures for dealing with the suspected presence of asbestos in the workplace

Range

AC4.3 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
- Levels of competency

AC4.5 Where asbestos may be encountered

- In decorative finishes (artex, plaster, floor tiles)
- In accessories (flash guards and matting in fuse carriers and on distribution board covers)
- In insulation storage compartments, vessels and pipework

Learning outcome

The learner will:

LO5 be able to establish a safe working environment

Assessment criteria

The learner can:

AC5.1 follow safe practices and **procedures** for the use of **equipment and materials** in the working environment

AC5.2 follow procedures for ensuring **electrical systems** are safe to work on (safe isolation procedure)

Range

AC5.1

Procedures

- Selection and checking correct power tools, hand tools or portable electrical equipment

Equipment and materials

- Manual handling techniques
- Powered access equipment (PASMA requirements)
- Ladders
- Use of mobile scaffold towers

- Portable power and hand tools
- Dangerous substances
- Use of signs and guarding

AC5.2 **Electrical systems**

- Single and three-phase supplies
- Single and three-phase circuits
- Single-phase equipment

Unit 101

Health, safety and environmental considerations in dwellings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|---|
| 1 | AC1.1 | K1, K2 |
| | AC1.2 | K3 |
| 2 | AC2.1 - 2.3 | K1, K4 |
| | AC2.4 - 2.6 | K1, K2, K3, K4, K7 |
| 3 | AC3.1-3.4 | K1, K2, K4, K5 |
| | AC3.5 | K2, K4, K5 |
| | AC3.6 - 3.8 | K1, K2 |
| | AC3.9 – 3. 11 | K1, K7, K10 |
| 4 | AC4.1 | K1, K2, K7 |
| | AC4.2 - 4.4 | K1, K4 |
| | AC4.5 - 4.6 | K1, K2, K7 |
| 5 | AC5.1 – 5.2 | K1,K2, K7, K10, S1, S2, S3, S7, S10, B1 |

Unit 102

Apply health, safety and environmental considerations in dwellings

| | |
|-------------------------|---|
| Level: | 3 |
| GLH: | 10 |
| Assessment type: | Portfolio of evidence |
| Aim: | This unit will enable learners to develop the competence required to apply Health and Safety legislation, practices and procedures when installing and maintaining electrical systems and equipment in dwellings. |

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 working in domestic dwelling environments 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 ensure that the Health and Safety of themselves and others is not endangered through personal conduct and behaviour within the workplace

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:

- 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 use appropriate procedures for the safe handling, storage and disposal of hazardous materials and products, in accordance with the:

- 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 in dwellings

Supporting Information

Unit 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:

- 101 Health, safety and environmental considerations in dwellings

Evidence requirements

Learning outcomes 1 to 4:

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.

AC3.5 use access equipment correctly. Assess **two** from the following:

- ladder
- tower scaffold or mewp
- stepladder
- platform

AC4.1 use 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

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|--|
| 1 | AC1.1 | K1, K2, S1, S2, S3, S7, B1 |
| | AC1.2 – 1.3 | K1, K2, S1, S2, S7, B1 |
| 2 | AC2.1 – 2.5 | K1, K2, K4, K5, K6, K10, S1, S2, S3, S5, S6, S7, S10, B1 |
| 3 | AC3.1 – 3.5 | K1, K2, K3, K4, K5, S1, S2, S3, S5, S6, B1, B2, B3, B4, B5, B6 |
| 4 | AC4.1 | K1, K2, K3, K4, K5, S1, S2, S3, S5, S6, B1, B2, B3, B4, B5, B6 |

Unit 103

Electrical scientific principles and technologies for work in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 110 |
| Assessment type: | Online multiple-choice test (closed book) Short answer test (closed book) |
| Aim: | This unit will enable learners to understand the relationship between electrical scientific principles and the competencies required of a qualified electrical operative working in dwellings. The knowledge covered in this unit underpins the application of skills in the installation and maintenance of electrical systems and equipment found in domestic electrical installations. Learners will also develop an understanding of renewable electrical energy technologies and their application in a residential context. The emphasis is on single-phase circuits, with an awareness only of three-phase where relevant to supplement the learning – particularly to underpin safe working. |

Learning outcome

The learner will:

LO1 understand mathematical principles and SI units

Assessment criteria

The learner can:

AC1.1 apply appropriate **mathematical principles**

AC1.2 identify internationally recognised base and derived **(SI) units of measurement and electrical quantities**

AC1.3 determine internationally recognised base and derived **(SI) units of measurement and electrical quantities**

AC1.4 identify electrical instruments for the measurement of **electrical quantities**

Range

AC1.1 **Mathematical principles**

- Fractions and percentages
- Basic transposition of formula

- Indices (to the power of)
- Triangles and trigonometry relating to right-angled triangles

AC1.2 and AC1.3

(SI) Units of measurement for

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

Electrical quantities (SI units)

- Resistance
- Resistivity
- Power
- Frequency
- Current
- Voltage
- Energy

AC1.4 **Electrical quantities** (measurement)

- Resistance
- Power
- Current
- Voltage
- Energy

Learning outcome

The learner will:

LO2 understand mechanical principles

Assessment criteria

The learner can:

AC2.1 define mass and weight

AC2.2 state the principles of mechanics as they apply to **levers**, gears and pulleys and **forces**

AC2.3 describe the main **mechanical principles** and their inter-relationships

AC2.4 calculate values of mechanical energy, power and efficiency

Range

AC2.2

Levers

- Class I
- Class II
- Class III

Forces

- Shear
- Torsion
- Bending
- Compression
- Tension

AC2.3 Mechanical principles:

- Force
- Work
- Energy (kinetic and potential)
- Power
- Efficiency

Learning outcome

The learner will:

LO3 understand the relationship between resistance, resistivity, voltage, current and power

Assessment criteria

The learner can:

AC3.1 describe the basic principles of electron theory

AC3.2 distinguish between materials which are good conductors and insulators

AC3.3 describe what is meant by resistance and resistivity in relation to electrical circuits

AC3.4 explain the relationship between current, voltage and resistance in parallel and series DC circuits

AC3.5 calculate the values of current, voltage and resistance in parallel and series DC circuits

AC3.6 calculate values of power in parallel and series DC circuits

AC3.7 state what is meant by the term voltage drop in relation to electrical circuits

AC3.8 describe the chemical and thermal effects of electric currents

Learning outcome

The learner will:

LO4 understand the relationship between magnetism and electricity

Assessment criteria

The learner can:

- AC4.1 describe the effects of magnetism in terms of attraction and repulsion
- AC4.2 describe the magnetic effects of electrical currents in terms of:
- production of a magnetic field
 - force on a current-carrying conductor in a magnetic field
 - electromagnetism
 - electromotive force
- AC4.3 describe magnetic flux and flux density
- AC4.4 describe the basic principles of generating an AC supply in terms of:
- a single-loop generator
 - sine-wave
 - frequency
 - EMF
 - magnetic flux
- AC4.5 identify the **characteristics of sine-waves**
- AC4.6 identify the harmful effects of electro-magnetic interference (EMI)
- AC4.7 identify types of transformers commonly used in dwellings
- AC4.8 describe the **operating principles, applications and limitations** of single-phase transformers
- AC4.9 determine by calculation:
- primary and secondary voltages
 - primary and secondary current
 - kVA rating of a transformer

Range

AC4.5 **Characteristics of sine-waves**

- Root Mean Square (RMS) value
- Periodic time
- Frequency
- Amplitude

AC4.8 **Operating principles, applications and limitations**

- Relationship between current and voltage
- Primary and secondary windings
- Step-up and step-down transformers

Learning outcome

The learner will:

- LO5 understand the types, applications, and limitations of electrical and electronic equipment

Assessment criteria

The learner can:

- AC5.1 describe the function and application of electrical and electronic equipment that are used in wired and wireless **electrical systems**

AC5.2 state the basic operating principles and software/hardware requirements of **electrical and electronic equipment**

Range

AC5.1 Electrical systems

- Power over ethernet (PoE)
- Security surveillance systems
- Fire detection
- Access systems
- Broadband, wired networks and WI-FI
- Lighting controls
- Heating controls
- Audio/visual systems

AC5.2 Electrical and electronic equipment

- Routers
 - Hubs
 - Control panels
 - Keypads
 - Voice activation devices
 - Connection leads
 - Switches
 - Controls (including app based controls)
 - Sensors
 - Detector types
-

Learning outcome

The learner will:

LO6 understand electrical supply systems

Assessment criteria

The learner can:

AC6.1 describe how electricity is generated and transmitted for domestic and industrial/commercial consumption

AC6.2 specify the **features and characteristics** of generation, transmission and distribution systems

AC6.3 describe the key difference between consumer installations and prosumer installations

AC6.4 state the operating principles of **other sources** of local electricity generation including island mode and prosumer systems

AC6.5 identify why load control/shedding is required

AC6.6 describe how load control/shedding and smart metering systems can reduce demand

Range

AC6.2 Features and characteristics

- Power stations
- Fossil fuels
- Hydro
- Nuclear
- Wind
- Solar
- Super-grid and standard grid system
- Network energy storage (smart grid)
- Transformers
- Transmission voltages
- Distribution voltages
- Sub-stations
- Above and below ground distribution
- Smart and dumb metering systems

AC6.4 **Other sources**

- Local battery storage systems, CPS or UPS systems
- Solar power (thermal and photovoltaic)
- Micro-hydro
- Micro-wind
- Electric vehicle systems (import and export)
- Combined Heat and Power (CHP) including micro CHP
- Inverters
- Rectifiers

Learning outcome

The learner will:

LO7 understand AC electrical properties

Assessment criteria

The learner can:

AC7.1 identify the relationship between resistance, inductance, capacitance and impedance

AC7.2 determine **electrical quantities** in alternating current circuits

AC7.3 identify the relationship between kW, kVAr, kVA and power factor

AC7.4 explain how electrical loads affect current demand

Range

AC7.2 **Electrical quantities**

- Resistance
- Inductance
- Inductive reactance
- Capacitance
- Capacitive reactance
- Impedance

Learning outcome

The learner will:

LO8 understand the operating principles of electrical components

Assessment criteria

The learner can:

AC8.1 explain the operating principles of **electrical components**

Range

AC8.1 Electrical components

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

Learning outcome

The learner will:

LO9 understand the principles and applications of electrical lighting systems

Assessment criteria

The learner can:

AC9.1 apply the basic **principles of illumination**

AC9.2 explain the operating principles, types, limitations and applications of **luminaires and lamp types**

AC9.3 explain the key technical aspects of **lighting specifications**

Range

AC9.1 Principles of illumination

- Inverse square law
- Cosine law

AC9.2 Luminaires and lamp types

- LED
 - General Lighting Service (GLS) incandescent and halogen
 - Discharge lighting
 - Energy saving (such as compact fluorescent lamps)
-

AC9.3 **Lighting specifications**

- Dimmer types and settings
 - Cap/connection types
 - Lumen output
 - Beam angle
 - Driver types
 - Colour temperature
 - Efficacy
-

Learning outcome

The learner will:

LO10 understand the principles and applications of heating systems

Assessment criteria

The learner can:

AC10.1 explain the basic **principles** of electrical space heating and electrical water heating

AC10.2 explain the operating principles, types, limitations and applications of **electrical space and water heating appliances and components**

AC10.3 apply heat loss calculations $R = T/K$, Heat Loss – $Q=UA (T1-T2)$

Range

AC10.1 **Principles**

- Convection cycle
- Conduction
- Radiation

AC10.2 **Electrical space and water heating appliances and components**

- Immersion heaters
 - Electric boiler systems
 - Heat pumps (ground and air source)
 - Storage heaters
 - Convector heaters
 - Under floor heating
 - Controls, timers and programmers for heating systems
 - Wet system valves and control circuit (S Plan; Y Plan etc)
-

Unit 103

Electrical scientific principles and technologies for work in dwellings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|-------------------------|----------------------------|---------------|
| 1 | AC1.1 | K9, S9 |
| | AC1.2 | K9 |
| | AC1.3 – 1.4 | K9, S9 |
| 2 | AC2.1 – 2.3 | K9 |
| | AC2.4 | K9, S9 |
| 3 | AC3.1 – 3.2 | K9 |
| | AC3.3 – 3.6 | K9, S9 |
| | AC3.7 - 3.8 | K9 |
| 4 | AC4.1 – 4.4 | K9 |
| | AC4.5 | K9, S9 |
| | AC4.6 – 4.8 | K9, K10 |
| | AC4.9 | K9, S9 |
| 5 | AC5.1 – 5.2 | K9, K11 |
| 6 | AC6.1 – 6.6 | K9, K11 |
| 7 | AC7.1 - 7.4 | K9, S9 |
| 8 | AC8.1 | K9 |
| 9 | AC9.1-9.3 | S9, K9, K11 |
| 10 | AC10.1 | K9, K11, S9 |
| | AC10.2 – 10.3 | K9, K10, S9 |

Unit 104

Design and installation practices and procedures for dwellings and associated buildings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 208 |
| Assessment type: | Online multiple-choice test (open book) Assignment (open book) Project (open book) |
| Aim: | <p>This unit will enable learners to develop the skills, knowledge and understanding to design, prepare and install wiring systems and associated equipment in domestic electrical installations in accordance with approved industry practices, statutory and non-statutory regulations. These include The Electricity at Work Regulations and BS 7671, Health and Safety at Work etc. Act, Building Regulations, Approved Documents, and other standards that affect the design, installation and performance of domestic electrical installations.</p> <p>The emphasis is on single phase circuits in a residential premises with an awareness only of three-phase where relevant to underpin safe working.</p> |

Learning outcome

The learner will:

LO1 know the documents affecting electrical design

Assessment criteria

The learner can:

AC1.1 identify **relevant sources of information** which will inform electrical design work in dwellings

AC1.2 identify the relevant Parts of the Building Regulations and **Approved Documents** that relate to electrical work in dwellings

Range

AC1.1 **Relevant sources of information**

- BS 7671
- BS 5839-6

- On-Site Guide
- Relevant Codes of Practice
- Manufacturer's instructions
- Client's specification

AC1.2 **Approved Documents**

- Part A
- Part B
- Part C
- Part D
- Part E
- Part F
- Part G
- Part J
- Part K
- Part L
- Part M
- Part P
- Part R
- Part S

Learning outcome

The learner will:

LO2 understand the applications of wiring systems common in dwellings

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 determine suitable support distances in line with industry guidance and regulations

AC2.5 describe the **factors** which affect the selection of **common wiring systems, associated equipment** and their enclosures

AC2.6 select suitable wiring systems and equipment appropriate to the situation and use

AC2.7 identify **older wiring systems and practices** commonly encountered in dwellings

AC2.8 explain actions needed when older wiring systems and cables are encountered

Range

AC2.1 **Electrical cables**

- Single and multicore thermosetting insulated cables including flexible cables
- Single and multicore thermoplastic (PVC) cables and flexible cables
- PVC/PVC flat profile cable
- SWA cables

- Data cables including PoE
- Signal cables including combined power and signal
- Fire resistant cable (not including MICC)
- DC cabling

AC2.2

Characteristics

- Constructional features
- Applications
- Advantages
- Limitations

Containment, support and wiring systems

- Conduit (PVC)
- Trunking (PVC)
- Cable basket
- Cable tray
- Clips
- Cleats
- Saddles

AC2.5

Factors

- Building
- Utilisation
- Environment
- Cost

Common wiring systems, associated equipment

- Lighting control systems
- Final circuits
- Distribution circuits
- Protection systems – Fire Alarm/Prevention; Access; Emergency Lighting
- Wired or wireless surveillance systems, communication, and data transmission systems

AC2.7 Older wiring systems and practices

- Historic wiring systems, (eg imperial sized conductors, rubber-sheathed cables, lead sheathed cables etc)
- Older colours, including green only CPC sleeving
- Voltage operated earth-leakage circuit breaker (pre-1981)
- Older socket-outlets
- Absence of CPC in lighting circuit
- Double pole fusing
- Mechanical systems being used as earthing
- Borrowed neutrals

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

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 specify the installation methods and procedures to ensure the installation **meets the specification and statutory and non-statutory regulations**

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

AC3.7 describe how to maintain fire and acoustic protection

Range

AC3.4 Criteria

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

AC3.5 Meets the specification and statutory and non-statutory regulations

- Compliance with building regulations when installing systems
- Wiring systems, enclosures, cables and components are securely fixed and installed
- A wiring system's mechanical integrity is maintained
- Measures are taken to minimise the risk of damage to the wiring system or its components

AC3.6 Building fabric

- 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 risk associated with TN-C-S systems and neutral current diversion (NCD) appearing on earthing systems
 - AC4.3 explain the characteristics and applications of single-phase supply systems
 - AC4.4 explain how **other local sources of supply and equipment** integrate with electrical supplies and systems
 - AC4.5 specify the arrangements for electrical installations and systems with regard to **provision for isolation, switching, protection and control**
-

Range

AC4.1 Earthing arrangements

- TN-S
- TNC-S
- TT

AC4.4 Other local sources of supply and equipment

- Photo-voltaic systems
- Micro-wind systems
- Micro-hydro systems
- Energy storage systems
- Electric vehicle exporting/importing energy
- Prosumers and island mode systems
- Smart and dumb metering
- Load control/shedding
- Inverters
- Rectifiers

AC4.5 Provision for isolation, switching, protection and control

- Isolation and switching
 - Overcurrent protection
 - Earth fault protection
 - Arc fault detection
 - Surge protection
 - DC isolators
-

Learning outcome

The learner will:

- LO5 understand the requirements and measures for protection against electric shock
-

Assessment criteria

The learner can:

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

Range

AC5.2 Relevant protective measures

- ADS
 - Electrical separation
 - SELV
-

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 describe the need for selectivity between protective devices
-

Range

AC6.1 Overcurrent

- Short circuits
- Earth faults
- Overloads

AC6.2 Protective devices

- Circuit breakers (CBs)
 - RCDs/RCBOs
 - Combined RCBO and AFDD
 - Fuses (BS 3036, semi-enclosed, BS 1362 cartridge, BS 88 HBC)
-

Learning outcome

The learner will:

LO7 understand electrical systems and circuits

Assessment criteria

The learner can:

AC7.1 describe the characteristics of standard **final electrical circuits**

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

AC7.3 describe key aspects for the design and installation of **alternative sources of supply**

AC7.4 describe factors that affect the design and installation of **electric vehicle charging circuits and equipment**

Range

AC7.1 Final electrical circuits

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

AC7.2 Electrical systems and circuits

- Distribution circuits
- Protection systems – fire alarm; access systems; emergency lighting, surveillance systems
- UPS and energy storage systems
- Fire detection systems including grades of building protection to BS 5839-6
- Communication and data transmission systems (broadband, wired networks and WI-FI)
- Wired and wireless heating control
- Wired and wireless lighting or power control

AC7.3 Alternative sources of supply

- Photo-voltaic systems
- Micro-wind systems
- Micro-hydro systems
- Energy storage systems
- Electric vehicle exporting/importing energy
- Prosumers and island mode systems
- Smart and dumb metering
- Load control/shedding
- Inverters
- Rectifiers

AC7.4 Electric vehicle charging circuits and equipment

- Charging modes and charging equipment suitable for dwellings
- Earthing arrangement and or open PEN detection
- Circuit protection suitable for AC or DC systems
- Supply considerations
- Installation checklists for dwellings as given in IET Codes of Practice

Learning outcome

The learner will:

LO8 understand electrical accessibility aids and accessibility requirements

Assessment criteria

The learner can:

AC8.1 identify specific regulatory requirements relating to the provision and installation of **electrical accessibility aids**

AC8.2 describe the key circuit requirements for, and current demand of standard **electrical accessibility aids**

AC8.3 identify the constructional requirements for **electrical accessibility aids**

AC8.4 outline the key characteristics of **electrical accessibility aids** and their application

AC8.5 Identify appropriate lighting designs and lux levels

Range

AC8.1-8.4 **Electrical accessibility aids**

- Lifts, elevators and stair lifts
 - Bedroom and bathroom hoists/person lifters
 - Disability and bariatric aids
 - Assisted living technologies and systems
 - Person alert systems (visual signals or sound signals)
-

Learning outcome

The learner will:

LO9 understand methods of terminating, connecting and supporting conductors and cables in electrical wiring systems and equipment

Assessment criteria

The learner can:

AC9.1 explain the advantages, limitations and applications of the following conductor connection methods:

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

AC9.2 describe the procedures for verifying that terminations and connections are electrically and mechanically sound

AC9.3 explain the consequences of terminations not being electrically and mechanically sound in terms of:

- a. high resistance joints
- b. corrosion and erosion

AC9.4 interpret the techniques and methods for the **safe** and effective termination to enclosures of:

- a. flexible and fine-wire cables
 - b. single and multicore thermoplastic (PVC) and thermosetting insulated cables
 - c. PVC/PVC flat profile cable
 - d. SWA cables
 - e. data cables
-

- f. signal cables
- g. DC cables
- h. fire performance cable (not MICC)

Range

AC9.4 Safe

- Selection and use of tools
- PPE
- Adherence to relevant statutory and non-statutory regulations

Learning outcome

The learner will:

LO10 be able to apply connections, terminations and supporting of conductors and cables

Assessment criteria

The learner can:

AC10.1 apply the following conductor connection methods:

- a. screw
- b. crimped
- c. non-screw compression
- d. compact lever
- e. insulation displacement

AC10.2 apply procedures for verifying that terminations and connections are electrically and mechanically sound

AC10.3 apply the techniques and methods for the **safe** and effective termination to enclosures of:

- a. flexible cables
- b. single and multicore thermoplastic (PVC) and thermosetting insulated cables
- c. PVC/PVC flat profile cable
- d. SWA cables
- e. data cables or signal cables
- f. fire performance cable (not MICC)

AC10.4 apply techniques and methods for **effective support** of cables

Range

AC10.3 Safe

- Selection and use of tools
- PPE
- Adherence to relevant statutory and non-statutory regulations

AC10.4 Effective support

- PVC conduit
- PVC trunking

- Cleats and clips
 - Glands and clamps
 - Cable tray
 - Regulatory requirements
-

Learning outcome

The learner will:

LO11 understand the electrical design procedure relevant to dwellings

Assessment criteria

The learner can:

AC11.1 state the purpose of diversity factors

AC11.2 select suitable current using equipment giving consideration to energy efficiency and relevant codes of practice for sustainability

AC11.3 determine the maximum demand (of an installation) after the application of diversity

AC11.4 determine the design current

AC11.5 select a suitably rated protective device

AC11.6 establish the installation method reference

AC11.7 determine appropriate rating factors

AC11.8 determine the minimum cross-sectional area of live conductors taking into consideration current carrying capacity and voltage drop

AC11.9 establish if the voltage drop is acceptable

AC11.10 verify if the disconnection times have been achieved

AC11.11 evaluate thermal constraints

AC11.12 interpret the requirements of **sources of information** in the design of an installation

Range

AC11.12 **Sources of information**

- BS 7671
- Guidance notes and On-Site Guide
- Guides to Building Regulations
- Other relevant standards
- Construction Design and Management (CDM) Regulations

Unit 104

Design and installation practices and procedures for dwellings and associated buildings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|--|
| 1 | AC1.1 – 1.2 | K7, K8, K12, K18, |
| 2 | AC2.1 – 2.2 | K7, K9, K11 |
| | AC2.3 – 2.4 | K7, K9 |
| | AC2.5 | K7, K12, |
| | AC2.6 | K7, K8, S7 |
| | AC2.7 – 2.8 | K1, K2, K7 |
| 3 | AC3.1 – 3.4 | K10 |
| | AC3.5 | K1, K7, K10, K12 |
| | AC3.6 | K3 K7 |
| | AC3.7 | K7 |
| 4 | AC4.1 - 4.3 | K1, K7, K11, K12 |
| | AC4.4 – 4.5 | K1, K7, K12 |
| 5 | AC5.1 – 5.7 | K1, K7, K12, S7 |
| 6 | AC6.1 – 6.4 | K1, K7, K10, K11, K12 |
| 7 | AC7.1 – 7.4 | K1, K7, K8, K9, K11 |
| 8 | AC8.1 – 8.5 | K1, K4, K5, K7, K8, K11, K13 |
| 9 | AC9.1 – 9.4 | K7, K10, K11, K12, K13 |
| 10 | AC10.1 -10.4 | K7, K10, K11, K13, S7, S8 |
| 11 | AC11.1 – 11.12 | K1, K7, K9, K12, S2, S7, S8, B1, B2, B3, B4, B5, B6 |

Unit 105

Practices and procedures for planning and overseeing electrical work activities in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 30 |
| Assessment type: | Assignment (open book) |
| Aim: | <p>This unit will enable learners to understand the practices and procedures used when planning electrical installation and maintenance work activities. Learners will develop the knowledge and skills needed for overseeing and organising work in dwellings.</p> <p>The emphasis is on single-phase circuits in a residential premises with an awareness only of three-phase where relevant to underpin safe working.</p> |

Learning outcome

The learner will:

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

Assessment criteria

The learner can:

- AC1.1 describe techniques and methods for the communication with **others** for the purpose of instruction and monitoring
- AC1.2 identify roles and responsibilities with regard to current **relevant employment legislation**
- AC1.3 describe aspects of Building Information Modelling (BIM) and how it can be used in project delivery
- AC1.4 describe techniques for remote communication using app and internet-based systems
- AC1.5 describe **methods** of determining competence
- AC1.6 describe how Continuing Professional Development (CPD) is used in developing the knowledge and skills of those working in the sector

Range

AC1.1 **Others**

- Clients
- Occupiers
- Local Authorities
- Building controls
- Trades and contractors

AC1.2 **Relevant employment legislation**

- Employment Rights Act
- Data Protection Act
- Equality Act
- Human Rights Act

AC1.5 **Methods**

- Checking competency cards (including CSCS/ECS cards, JIB cards)
- Checking qualifications
- Competent Person Scheme Registration

Learning outcome

The learner will:

LO2 understand the requirements for procuring projects within the construction sector

Assessment criteria

The learner can:

AC2.1 describe the types of common **procurement routes**

AC2.2 state the **methods** of tendering and costing work

AC2.3 state factors that affect business overheads

AC2.4 describe methods used to interpret client requirements

AC2.5 state how the **supply chain** integrates through partnering and collaborative practices

Range

AC2.1 **Procurement routes**

- Contractor led
- Design and build
- Fast track
- Lump sum
- Single stage
- Two-stage

AC2.2 **Methods**

- Open
- Negotiated
- Selective
- Two-stage
- Preferred supplier

- Quotation
- Estimate

AC2.5 **Supply chain**

- Client
- Architect
- Engineers
- Building contractor
- Sub-contractors
- Operatives
- Manufacturers
- Suppliers
- Local Authorities (planning process)

Learning outcome

The learner will:

LO3 understand the requirements for project managing work in dwellings

Assessment criteria

The learner can:

- AC3.1 specify the **procedure** for completing and handing over work from the point of initial enquiry
- AC3.2 describe how to plan and implement work allocations including coordination with other services and personnel
- AC3.3 explain how the work completion time is estimated taking into account **influential factors**
- AC3.4 specify procedures for re-scheduling work to co-ordinate with changing conditions in the workplace and to coincide with other trades or client's wishes
- AC3.5 specify **documentation** that is required during work operations or contracts
- AC3.6 describe **customer service principles**
- AC3.7 state the importance of undertaking a **pre-work survey** prior to commencement of any work activity
- AC3.8 explain how to check for any pre-existing damage to customer/client property:
- a. equipment and components
 - b. building décor and floor finishes
- AC3.9 specify methods for protecting the fabric and structure of the property before and during electrical work

Range

AC3.1 **Procedure**

- Initial enquiry
- Costing work
- Planning requirements (permitted development, planning permission)
- Building controls and regulations

- Client needs
- Pre-work survey
- Undertaking the work
- Inspection and testing
- Commissioning
- Hand-over including documentation and information
- Project evaluation/measuring success

AC3.3 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

AC3.5 Documentation

- Estimates
- Quotation
- Tender
- Variation order
- Purchase order
- Daywork sheets
- Timesheets
- Site diary
- Requisitions
- Delivery note
- Building regulation approvals
- Planning permission

AC3.6 Customer service principles

- Having good product knowledge
- Building trust
- Meeting timescales
- Good communication
- Efficiency
- Honesty and integrity

AC3.7 Pre-work survey

- Survey of the general characteristics as Part 3 of BS 7671
- Need for temporary supplies or services

Learning outcome

The learner will:

LO4 understand the management and use of data and information

Assessment criteria

The learner can:

AC4.1 interpret **types of information** and data sources used within construction and building services projects

AC4.2 state methods of data management to maintain confidentiality

AC4.3 interpret **types of drawings, diagrams and schematics**

Range

AC4.1 **Types of information**

- Product data
- Manufacturer's specifications
- Client's specifications
- Common Data Environment
- Building Information Modelling (BIM)
- Gantt charts
- Critical path networks
- Certification and commissioning data
- Test data schedules
- Condition reports
- Carbon emissions

AC4.3 **Types of drawings, diagrams and schematics**

- Symbols
- Circuit diagram
- Wiring diagram
- Layout and schematic drawings
- Building/site plans

Unit 105

Practices and procedures for planning and overseeing electrical work activities in dwellings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|---|
| 1 | AC1.1 | K1, K4, K5 |
| | AC1.2 | K1, K4, K5, K7 |
| | AC1.3 | K4, K5, K15, K18 |
| | AC1.4 | K4, K5, K18, K19 |
| | AC1.5 | K1, K7 |
| | AC1.6 | K1, K6, K19 |
| 2 | AC2.1 – 2.2 | K4, K5, K16, K18 |
| | AC2.3 | K16, K18 |
| | AC2.4 – 2.5 | K4, K5, K18 |
| 3 | AC3.1 – 3.4 | K4, K5, K18 |
| | AC3.5 | K15, K16 |
| | AC3.6 | K4, K5 |
| | AC3.7 – 3.9 | K3 |
| 4 | AC4.1 – 4.3 | K4, K5, K8, K12, K16, K17, K18, S8, S11 |

Unit 106

Plan and oversee the electrical work activities in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 12 |
| Assessment type: | Portfolio of evidence |
| Aim: | This unit will enable learners to develop the competence required to 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 co-ordinate liaison with other relevant persons during work activities

Assessment criteria

The learner can:

- AC2.1 select effective methods to co-ordinate with other workers/contractors, including steps to resolve issues or delays
- AC2.2 apply communication techniques that are clear, accurate and appropriate to the situation
- AC2.3 apply principles of customer service

Learning outcome

The learner will:

LO3 be able to organise and oversee work activities and operations in dwellings

Assessment criteria

The learner can:

AC3.1 organise operatives by allocating duties and responsibilities to make the best use of their competence and skill

AC3.2 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

Learning outcome

The learner will:

LO4 be able to organise a programme for working on single-phase electrical systems and equipment

Assessment criteria

The learner can:

AC4.1 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

AC4.2 communicate with others clearly and concisely

AC4.3 liaise with other relevant parties to resolve issues or delays

Learning outcome

The learner will:

LO5 be able to organise the resource requirements for work on electrical systems and equipment in dwellings

Assessment criteria

The learner can:

AC5.1 organise provision of resources to include:

- a. materials
- b. fixings
- c. plant
- d. labour
- e. tools

AC5.2 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

AC5.3 ensure that resources are undamaged at the point of delivery

AC5.4 implement measures which ensure the safe and effective storage of materials, tools and equipment in the work location

Unit 106

Plan and oversee the electrical work activities in dwellings

Supporting Information

Unit 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:

- 105 Practices and procedures for planning and overseeing electrical work activities in dwellings

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 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.

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|--|
| 1 | AC1.1 – 1.3 | K1, K2, K4, K5, K16, S1, S2, S5, S6, S7, S17, B1, B2, B3, B4, B5, B6 |
| 2 | AC2.1 – 2.3 | K4, K5, S5, S6, S17, B1, B2, B3, B4, B5, B6 |
| 3 | AC3.1 – 3.2 | K1, K2, K4, K5, K7, S1, S2, S3, S4, S5, S7, S8, B1, B2, B3, B4, B5, B6 |
| 4 | AC4.1 – 4.3 | K4, K5, K6, S5, S6, S7, S8, S17 |
| 5 | AC5.1 – 5.4 | K1, K2, K8, K10, S2, S5, S7, S8, S10, B1, B2, B3, B4, B5, B6 |

Unit 109

Apply design and installation practices including termination and connection of conductors in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 35 |
| Assessment type: | Portfolio of evidence |
| Aim: | <p>This unit will enable learners to develop the competence required to terminate and connect conductors and cables in electrical systems, and plan, prepare and install wiring systems and associated equipment in dwellings in accordance with approved industry practices, statutory and non-statutory regulations:</p> <ul style="list-style-type: none">• The Electricity at Work Regulations• The current edition of BS 7671• Health & Safety Act• Building Regulations |

Learning outcome

The learner will:

LO1 prepare to install wiring systems, enclosures and associated equipment in dwellings

Assessment criteria

The learner can:

AC1.1 apply appropriate procedures to include:

- adopting appropriate PPE
- following a safe system of work (eg working in accordance with a risk assessment and method statement)
- selecting appropriate tools/equipment for the installation work

AC1.2 prepare to install wiring systems, enclosures and associated equipment, to include:

- report any pre-work damage/defects to existing equipment or building features, to the relevant person (such as customer/client, site/line manager)
- confirm site readiness for installation work to begin
- confirm authorisation for the installation work to start

AC1.3 use documentation to confirm that materials and equipment are of the correct quantity and are 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:

- specifications
 - work schedules/programmes
 - manufacturer instructions
 - layout drawings
 - 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 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:

- single core (singles)
- multicore insulated
- PVC - PVC flat profile cable
- DC cabling
- SWA cable
- data including PoE
- fire resistant cabling (not including MICC)

AC3.3 install the following in accordance with the wiring regulations, the installation specification and agreed planned programme of work:

- PVC conduit
 - PVC trunking
 - cable basket
 - cable tray
-

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:

- a. distribution boards/consumer units
- b. socket outlets
- c. luminaires
- d. isolators/switches
- e. overcurrent protective devices

and

- electric vehicle charging point
- fire detection components
- data socket outlets
- WI-FI router
- Smart camera and or Smart doorbell
- Smart lighting control (not individual Smart lamp)
- Smart heating controls including hard wired connections
- other appropriate equipment within a dwelling (eg heating system components, control equipment)

AC3.5 dispose of waste materials in accordance with site procedures and statutory requirements

Learning outcome

The learner will:

LO4 confirm the quality of the completed work

Assessment criteria

The learner can:

AC4.1 make good all parts of the building following installation work

AC4.2 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

Learning outcome

The learner will:

LO5 prepare to terminate and connect cables and conductors used in dwellings

Assessment criteria

The learner can:

AC5.1 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)

AC5.2 ensure 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:

LO6 terminate and connect conductors and cables used in dwellings

Assessment criteria

The learner can:

AC6.1 terminate and connect cables and conductors in accordance with manufacturers' instructions, BS 7671, and any relevant drawing or specification:

- single core (singles)
- multicore insulated
- PVC - PVC flat profile cable
- DC cabling
- SWA cable
- data including PoE
- fire resistant cabling (not including MICC)

AC6.2 connect to electrical equipment in accordance with manufacturers' instructions, BS 7671, and any relevant drawing or specification:

- isolators/switches
- socket outlets
- distribution boards/consumer control units
- luminaires
- overcurrent protective devices
- earthing terminals
- data socket outlets or data connections
- wired fire detection/alarm components
- other appropriate equipment within a dwelling (such as heating system components)

AC6.3 terminate and connect conductors, using appropriate methods:

- screwing
- crimping
- non-screw compression
- insulation displacement

AC6.4 ensure that terminations and connections are electrically and mechanically sound (inspecting and testing terminations)

AC6.5 ensure cables have appropriate identification in accordance with BS 7671

Unit 109

Apply design and installation practices including termination and connection of conductors in dwellings

Supporting Information

Unit 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:

- 104 Design and installation practices and procedures for dwellings and associated buildings

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 apply design and installation practices including termination and connection of conductors 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.

Evidence requirements

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

Assess **two** of the following:

- specifications
- work schedules/programmes
- manufacturer instructions
- layout drawings
- other appropriate source of information (eg BS 7671, other plans or diagrams, 'approved documents', building regulations)

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

Assess **four** from:

- single core (singles)
- multicore insulated
- PVC - PVC flat profile cable
- DC cabling
- SWA cable
- data including PoE
- fire resistant cabling (not including MICC)

AC3.3 install the following in accordance with the wiring regulations, the installation specification and agreed planned programme of work:

Assess **three** from:

- PVC conduit
- PVC trunking
- cable basket
- cable tray

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 the following:

- a. distribution boards/consumer units
- b. socket outlets
- c. luminaires
- d. isolators/switches
- e. overcurrent protective devices

and

Assess **four** from the following:

- electric vehicle charging point
- fire detection components
- data socket outlets
- WI-FI router
- Smart camera and or Smart doorbell
- Smart lighting control (not individual Smart lamp)
- Smart heating controls including hard wired connections
- other appropriate equipment within a dwelling (eg heating system components, control equipment)

AC6.1 terminate and connect cables and conductors in accordance with manufacturers' instructions, BS 7671, and any relevant drawing or specification:

Assess **four** from the following:

- single core (singles)
- multicore insulated
- PVC - PVC flat profile cable
- DC cabling
- SWA cable
- data including PoE
- fire resistant cabling (not including MICC)

AC6.2 connect to electrical equipment in accordance with manufacturers' instructions, BS 7671, and any relevant drawing or specification:

Assess **five** from the following:

- isolators /switches
- socket outlets
- distribution-boards / consumer control units
- luminaires
- overcurrent protective devices
- earthing terminals
- data socket outlets or data connections
- wired fire detection/alarm components
- other appropriate equipment within a dwelling (such as heating system components)

AC6.3 terminate and connect conductors, using appropriate methods:

Assess **two** from the following:

- screwing
- crimping
- non-screw compression
- insulation displacement

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|--|
| 1 | AC1.1 | K1, K2, K7, K8, S1, S2, S3, S7, B1, B2, B3, B4, B5, B6 |
| | AC1.2 | K1, K4, K5, K7, K8, S2, S5, S6, S7, S8, B1, B2, B3, B4, B5, B6 |
| | AC1.3 | K8, S7, S8, B1, B2, B3, B4, B5, B6 |
| | AC1.4 | K1, K7, K8, S2, S7, B1, B2, B3, B4, B5, B6 |
| | AC1.5 | K1, K7, S2, S7, B1, B2, B3, B4, B5, B6 |
| 2 | AC2.1 | K7, K8 S2, S7, S8, B3, B1, B2, B3, B4, B5, B6 |
| 3 | AC3.1 | K1, K2, K3, K4, K5, K6, K7, K8, K10, K11, K12, K13, S2, S7, S10, S11, B1, B2, B3, B4, B5, B6 |
| | AC3.2 – 3.4 | K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, B1, B2, B3, B4, B5, B6 |
| | AC3.5 | K1, K2, K3, K4, K5, K6, K7, K8, K10, K11, K12, K13, S2, S4, B1, B2, B3, B4, B5, B6 |
| 4 | AC4.1 - 4.2 | K1, K3, K7, K8, K13, S2, S4, B1, B2, B3, B4, B5, B6 |
| 5 | AC5.1 - 5.2 | K1, K2, K7, K8, K10, K13, S7, S10, S11, B1, B2, B3, B4, B5, B6 |

| Learning outcome | Assessment criteria | KSB(s) |
|-------------------------|----------------------------|--|
| 6 | AC6.1 – 6.5 | K1, K2, K3, K4, K5, K6, K7, K8, K10, K11, K12, K13, S7, S11, S15, B1, B2, B3, B4, B5, B6 |

Unit 112

Practices and procedures for inspection, testing and commissioning in dwellings

| | |
|-------------------------|---|
| Level: | 3 |
| GLH: | 82 |
| Assessment type: | Online multiple-choice test (closed book) Assignment (open book) |
| Aim: | <p>This unit will enable learners to understand the principles, practices and legislation for the initial verification and periodical inspection of electrical installations to statutory and non-statutory regulations and requirements.</p> <p>Learners will develop the knowledge and skills needed for the inspection, testing, commissioning, certification and reporting of electrical installations, including the condition of existing systems.</p> <p>The emphasis is on single phase circuits in a residential premises with an awareness only of three-phase where relevant to underpin safe working.</p> |

Learning outcome

The learner will:

- LO1 understand the requirements for completing the safe isolation of single-phase 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 identify methods and reasons for communicating with relevant people before isolation or when reconnecting the supply
- AC1.3 specify the appropriate **procedure** for completing safe isolation
- AC1.4 state the **reasons** for carrying out safe isolation
- AC1.5 state the **implications** of carrying out safe isolation
- AC1.6 state the **implications** of not carrying out safe isolation
- AC1.7 identify the **Health and Safety requirements** which apply when inspecting, testing and commissioning electrical installations and circuits
- AC1.8 identify the procedure for detecting potential diverted neutral currents

Range

AC1.1 **Requirements** in terms of:

- Those carrying out the work
- Those using the premises during the inspection

AC1.3 **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

AC1.4 **Reasons** in relation to:

- The inspector
- Client and others
- Building systems

AC1.5 and AC1.6 **Implications** in relation to:

- The inspector
- Client and others
- Building systems (removal of supply)

AC1.7 **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

Learning outcome

The learner will:

LO2 understand the requirements for initial verification of single-phase electrical installations in dwellings

Assessment criteria

The learner can:

AC2.1 state the purpose of the initial verification of electrical installations

AC2.2 state the requirements of the initial verification

AC2.3 identify the **relevant documents** associated with the inspection, testing and commissioning of an electrical installation

AC2.4 specify the information that is required by the inspector to conduct the initial verification of an electrical installation

Range

AC2.3 Relevant documents

- Electricity at Work Regulations
- BS 7671
- IET Guidance Note 3
- IET On-Site Guide
- HSE Guidance

Learning outcome

The learner will:

LO3 understand the requirements for completing the inspection of single-phase electrical installations in dwellings, 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 as detailed in the guidance for inspection in BS 7671

Learning outcome

The learner will:

LO4 understand the requirements for the safe testing and commissioning of single-phase electrical installations in dwellings

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

AC5.3 **Factors that affect conductor resistance values**

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

AC5.4 **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 single-phase 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 in single-phase installations
 - 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 need for functional testing
 - AC6.10 identify items which require functional testing
 - AC6.11 state the appropriate **procedures for dealing with clients** during the commissioning and certification process
-

Range

AC6.3 Common earth fault loop paths

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

AC6.4 Methods for verifying protection

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

AC6.11 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 electrical installation certificates and associated 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 initial verification **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 initial verification documentation in accordance with the BS 7671

Range

AC7.1 and 7.2 **Documentation**

- An Electrical Installation Certificate and associated documents
 - A Minor Electrical Installation Works Certificate
-

Learning outcome

The learner will:

LO8 understand the requirements for the periodic inspection and testing of existing electrical installations in dwellings

Assessment criteria

The learner can:

AC8.1 explain the purpose of condition reports and associated documentation

AC8.2 state the information that must be available to person to enable effective periodic inspection

AC8.3 describe how to set samples when undertaking periodic inspection and testing

AC8.4 explain extents, limitations and operating constraints which need considering

AC8.5 explain the differences between initial verification and periodic inspection and testing

AC8.6 explain the purpose of condition report codes and situations leading to the use of each code

Learning outcome

The learner will:

LO9 be able to confirm safety of single-phase system and equipment prior to completion of inspection, testing and commissioning

Assessment criteria

The learner can:

AC9.1 carry out safe isolation procedures in accordance with regulatory requirements

AC9.2 comply with the Health and Safety requirements of themselves and others within the work location during the initial verifications process

AC9.3 check the safety of electrical systems prior to the commencement of inspection, testing and commissioning

Learning outcome

The learner will:

LO10 be able to carry out inspection of electrical installations prior to them being placed into service

Assessment criteria

The learner can:

AC10.1 identify a safe system of work appropriate to the work activity

AC10.2 carry out an initial inspection of an electrical installation in accordance with the requirements of BS 7671 and IET Guidance Note 3

AC10.3 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:

LO11 be able to test single-phase electrical installations prior to them being placed into service

Assessment criteria

The learner can:

AC11.1 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. functional testing

AC11.2 evaluate the appropriate tests suitable for the installation to be verified

AC11.3 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 (Z_e)
- e. system earth fault loop impedance (Z_s)
- f. prospective fault current
- g. RCD operation including additional protection
- h. functional testing

AC11.4 confirm compliance by evaluating and verifying test results

AC11.5 complete appropriate documentation in accordance with the BS 7671 and IET Guidance Note 3 including Electrical Installation Certificate and associated schedules

Learning outcome

The learner will:

LO12 be able to commission single-phase electrical systems and equipment

Assessment criteria

The learner can:

AC12.1 clarify the commissioning procedures with relevant persons

AC12.2 carry out the commissioning of circuits, accessories and equipment to confirm functionality

Learning outcome

The learner will:

LO13 be able to report on the condition of existing single-phase electrical systems and equipment

Assessment criteria

The learner can:

AC13.1 identify situations requiring reporting as part of a periodic inspection and test

AC13.2 apply a suitable **report code** to situations

Range

AC2.1 **Report code**

- C1
- C2
- C3
- FI

Unit 112

Practices and procedures for inspection, testing and commissioning in dwellings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|---|
| 1 | AC1.1 | K1, K2, K4, K5, K7, K10 |
| | AC1.2 | K4, K5 |
| | AC1.3 – 1.7 | K1, K7 |
| | AC1.8 | K7, K10 |
| 2 | AC2.1 – 2.2 | K1, K7, K14 |
| | AC2.3 – 2.4 | K7, K8 |
| 3 | AC3.1 | K7, K8, S2, S7, B1, B2, B3, B4, B5, B6 |
| | AC3.2 – 3 | K14 |
| | AC3.4 | K1, K7 |
| 4 | AC4.1 – 4.6 | K1, K7, K10 |
| 5 | AC5.1 – 5.7 | K7, K9, K13, K14 |
| 6 | AC6.1 - 6.10 | K7, K9, K10, K14 |
| | AC6.11 | K4, K5, K15 |
| 7 | AC7.1 - 7.5 | K7, K8, K15, K17 |
| 8 | AC8.1 – 8.6 | K7, K14, K15, K17 |
| 9 | AC9.1 – 9.3 | K1, K4, K5, K7, K8, S1 S2, S5, S6, S7, B1, B3, B4, B5, B6 |
| 10 | AC10.1 – 10.3 | K1, K7, K8, K10, K14, K15, K17, S1, S2, S3, S7, S8, S16, B1, B2, B3, B4, B5, B6 |
| 11 | AC11.1 – 11.5 | K1, K7, K8, K10, K14, K15, K17, S1, S2, S3, S7, B1, B2, B3, B4, B5, B6 |
| 12 | AC12.1 – 12.2 | K4, K5, K7, K8, K10, S5, S6, S7, S8, S16, B1, B2, B3, B4, B5, B6 |
| 13 | AC13.1 – 13.2 | K1, K7, K10, K14, K16, K17, S7, S8, S13 S15, S16, B1, B2, B3, B4, B5, B6 |

Unit 113

Inspect, test, report and commission electrical systems in dwellings

| | |
|-------------------------|---|
| Level: | 3 |
| GLH: | 12 |
| Assessment type: | Portfolio of evidence |
| Aim: | <p>This unit will enable learners to develop the competence required to inspect, test, commission and certify or report on electrical systems and equipment in buildings, structures and the environment in accordance with approved industry practices, statutory and non-statutory regulations:</p> <ul style="list-style-type: none">• The Electricity at Work Regulations• The current edition of BS 7671• Health & Safety Act• Building Regulations |

Learning outcome

The learner will:

- LO1 be able to confirm safety of the system and equipment prior to completion of inspection, testing and commissioning of single-phase systems 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 check for diverted neutral currents on PME installations
- AC1.3 ensure the Health and Safety of themselves and others within the work location during inspection, testing and commissioning
- AC1.4 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 single-phase 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 necessary inspections documentation 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 single-phase 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 7671 and manufacturer's instructions. Tests include:

- a. continuity
- b. insulation resistance
- c. polarity
- d. earth fault loop impedance/earth electrode
- e. prospective fault current
- f. RCD operation
- g. functional testing

AC3.3 verify test results reporting all findings to relevant persons, as appropriate:

- a. representatives of other services/colleagues
- b. customers/clients

AC3.4 complete in accordance with BS 7671 and IET Guidance Note 3:

- a. Electrical Installation Certificates and associated documents
- 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

Learning outcome

The learner will:

LO4 be able to inspect, test and report on the condition of an existing electrical installation

Assessment criteria

The learner can:

- AC4.1 collate the information that is needed to enable sampling to be set
- AC4.2 agree and set samples with client and other stakeholders based on the quality of information and systems and maintenance
- AC4.3 agree extents and limitations with client and/or other stakeholders
- AC4.4 carry out an inspection of an installation in accordance with the agreed sample, extents and limitations
- AC4.5 carry out the necessary tests of an installation in accordance with the agreed sample, extents and limitations
- AC4.6 report on the condition of an installation using the correct report codes and documentation
- AC4.7 communicate findings of report to necessary stakeholders following completion of the report

Unit 113

Inspect, test, report and commission electrical systems in dwellings

Supporting Information

Unit 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:

- 104 Design and installation practices and procedures for dwellings and associated buildings
- 112 Practices and procedures for inspection, testing and commissioning in dwellings

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 4 – 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, certifying or reporting on the condition 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.

Learning Outcome 4 must be undertaken in a real working environment on an installation having a minimum of six existing circuits that have been in operation a minimum of three years. This assessment may be undertaken before new, additional or altered wiring is installed within the same building but is not valid if undertaken alongside an initial verification of any new parts of the installation.

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.

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|-------------------------|----------------------------|--|
| 1 | AC1.1 – 1.4 | K1, K2, K4, K5, K10, S1, S2, S3, S4, S5, S6, S7, S10, B1, B4, B5, B6 |
| 2 | AC2.1 – 2.4 | K1, K2, K7, K10, K14, S1, S2, S3, S4, S7, S8, S10, B1, B4, B5, B6 |
| 3 | AC3.1 – 3.6 | K1, K2, K3, K4, K5, K7, K8, K9, K10, K11, K12, K13, K14, K15, K17, S1, S2, S3, S4, S5, S6, S7, S8, S10, S11, S12, S13, S14, S15, S16, B1, B2, B3, B4, B5, B6 |
| 4 | AC4.1 – 4.7 | K1, K2, K3, K4, K5, K7, K8, K9, K10, K11, K12, K13, K14, K15, K17, S1, S2, S3, S4, S5, S6, S7, S8, S10, S11, S12, S13, S14, S15, S16, B1, B2, B3, B4, B5, B6 |

Unit 114

Practices and procedures for fault diagnosis and rectification in dwellings

| | |
|-------------------------|---|
| Level: | 3 |
| GLH: | 29 |
| Assessment type: | Online multiple-choice test (closed book) Assignment (open book) |
| Aim: | <p>This unit will enable learners to understand the principles, practices and legislation associated with diagnosing and correcting electrical faults in electrical systems and equipment in dwellings in accordance with statutory and non-statutory regulations and requirements. Learners will develop the knowledge and skills used for fault diagnosis and correction in electrical systems and equipment in dwellings.</p> <p>The emphasis is on single phase circuits in a residential premises with an awareness only of three-phase where relevant to underpin safe working.</p> |

Learning outcome

The learner will:

LO1 understand the importance of reporting and communication during fault diagnosis work in dwellings

Assessment criteria

The learner can:

AC1.1 describe the documentation relevant to fault diagnosis

AC1.2 state the **implications** of the fault diagnosis for customers and clients.

AC1.3 explain the **communication requirements** relevant to fault diagnosis

AC1.4 state the dangers of electricity in relation to fault diagnosis work

Range

AC1.2 **Implications**

- Loss of circuits
- Equipment

AC1.3 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
 - Why clients need to be kept informed during completion of fault correction work
-

Learning outcome

The learner will:

LO2 understand the nature and characteristics of electrical faults in dwellings

Assessment criteria

The learner can:

AC2.1 identify types, causes and consequences of **electrical faults**

AC2.2 describe typical types of faults and their likely **locations in wiring systems** and equipment

Range

AC2.1 Electrical faults

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

AC2.2 Locations in wiring systems

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

Learning outcome

The learner will:

LO3 understand the fault diagnosis procedure for single-phase electrical systems

Assessment criteria

The learner can:

AC3.1 state precautions that must be taken when carrying out fault diagnosis with regard to **particular locations, equipment and circumstances**

AC3.2 explain the **logical stages** of fault diagnosis

AC3.3 select the appropriate **test instrument/s** for fault diagnosis work

AC3.4 describe how **test instruments** are confirmed to be fit for purpose and functioning correctly

AC3.5 specify appropriate and logical procedures for carrying out fault diagnosis **tests**

AC3.6 determine if **test** results are acceptable

Range

AC3.1 Particular locations, equipment and circumstances

- Lone working
- Electronic devices (damage by over voltage)
- Presence of batteries
- Additional and alternative sources of energy
- Time controlled devices

AC3.2 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 (previous inspection and test documents)
- Communicating with clients 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 GS38

AC3.3 and 3.4 Test instrument/s

- Voltage indicator
- Low resistance ohm meter
- Insulation resistance testers
- EFLI and PFC tester
- RCD tester
- Ammeter
- Battery tester
- Multi-meter (component testing)
- GS38

AC3.5 and 3.6 Tests

- Continuity
 - Insulation resistance
 - Polarity
 - Earth fault loop impedance
-

- RCD operation
 - Current and voltage measurement
 - Functional testing/checking
-

Learning outcome

The learner will:

LO4 understand the procedures and techniques for correcting electrical faults in dwellings

Assessment criteria

The learner can:

AC4.1 identify **factors** which can affect repair or replacement of equipment

AC4.2 specify the procedures for **verifying** that the fault has been corrected suitable for the situation using technical analysis

AC4.3 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

AC4.1 Factors

- Cost
- Availability of replacement parts and resources
- Downtime (planning)
- Legal and personal responsibility (eg contracts, warranties, relevant personnel)
- Access to systems and equipment
- Provision of emergency or standby supplies

AC4.2 Verifying

- Functional testing/checking
 - Continuity
 - Insulation resistance
 - Polarity
 - Earth fault loop impedance
 - RCD operation
 - Current and voltage measurement/checking presence of supply
-

Learning outcome

The learner will:

LO5 be able to carry out fault diagnosis in dwellings

Assessment criteria

The learner can:

AC5.1 follow safe working procedures

AC5.2 apply appropriate fault diagnosis **methods** and techniques

AC5.3 diagnose electrical faults using engineering decision and evaluation of symptoms and findings

AC5.4 recommend the appropriate action/s to correct faults

Range

AC5.2 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 114

Practices and procedures for fault diagnosis and rectification in dwellings

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|--|
| 1 | AC1.1 | K7, K8, K17 |
| | AC1.2 – 1.4 | K1, K4, K5, K7, K14, K15 |
| 2 | AC2.1 – 2.2 | K1, K7, K11, K13, K14 |
| 3 | AC3.1 – 3.6 | K1, K2, K7, K10, K11, K14 |
| 4 | AC4.1 – 4.2 | K1, K4, K5, K7, K8, K14 |
| | AC4.3 | K2, K4, K5 |
| 5 | AC5.1 - 5.4 | K1, K7, K8, K10, K11, K14, S2, S4, S7, S8, S12, S13, S15, B1, B2, B3, B4, B5, B6 |

Unit 115

Apply fault diagnosis and rectification in dwellings

| | |
|-------------------------|--|
| Level: | 3 |
| GLH: | 10 |
| Assessment type: | Portfolio of evidence |
| Aim: | <p>This unit will enable learners to develop 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:</p> <ul style="list-style-type: none">• The Electricity at Work Regulations• The current edition of BS 7671• Health & Safety Act• Building Regulations |

Learning outcome

The learner will:

LO1 prepare to carry out fault diagnosis in dwellings

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 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 in dwellings

Assessment criteria

The learner can:

- AC2.1 communicate effectively with relevant personnel (eg customer) to ascertain the nature of the fault
- AC2.2 interpret documents which relate to the electrical systems and equipment being worked upon
- AC2.3 communicate potential disruption that may be a consequence of fault diagnosis and correction work to relevant people, to include:
- 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:
- loss of supply
 - overload
 - short-circuit
 - earth fault
 - high resistance joints/loose terminations
 - component, accessory or equipment faults
 - open circuit
- 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:
- voltage indicator
 - low resistance ohm meter
 - insulation resistance tester
 - EFLI and PFC tester
 - RCD tester
 - ammeter
 - other appropriate instrument

Learning outcome

The learner will:

LO3 carry out fault rectification in dwellings

Assessment criteria

The learner can:

- AC3.1 assess the appropriate repairs, removals and replacements and their implications with relevant people:
- other workers/colleagues
 - customers/clients

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

AC3.3 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 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 perform an 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 information regarding the fault correction work clearly and accurately and report it to relevant people:

- other workers/colleagues
- customers/clients
- representatives of other services

Unit 115

Apply fault diagnosis and rectification in dwellings

Supporting Information

Unit 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:

- 114 Practices and procedures for fault diagnosis and rectification in dwellings

Learning Outcomes 1 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 fault diagnosis and rectification 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.

Evidence requirements

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

Assess **three** from the following:

- loss of supply
- overload
- short-circuit
- earth fault
- high resistance joints/loose terminations
- component, accessory or equipment faults
- open circuit

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

Assess **three** of the following:

- voltage indicator
- low resistance ohm meter
- insulation resistance tester
- EFLI and PFC tester
- RCD tester
- ammeter
- other appropriate instrument

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

Assess **one** of the following:

- other workers/colleagues
- customers/clients

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

Assess **one** of the following:

- other workers/colleagues
- customers/clients
- representatives of other services

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

| Learning outcome | Assessment criteria | KSB(s) |
|------------------|---------------------|---|
| 1 | AC1.1 – 1.4 | K1, K3, K4, K5, K6, K7, K8, K10, K14, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S13, S15, S16, B1, B2, B3, B4, B5, B6 |
| 2 | AC2.1 - 2.8 | K1, K3, K4, K5, K6, K7, K8, K10, K13, K14, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S12, S13, S15, S16, B1, B2, B3, B4, B5, B6, |
| 3 | AC3.1 – 3.6 | K1, K3, K4, K5, K7, K8, K10, K11, K14, K15, K16, K17, K18, S1, S2, S4, S5, S6, S7, S8, S9, S10, S13, S15, S16, B1, B2, B3, B4, B5, B6 |

Unit 022

Understand the Requirements for Electrical Installations BS 7671: 2018 (2022)

| | |
|-------------------------|---|
| Level: | 3 |
| GLH: | 70 |
| Assessment type: | Online multiple-choice test (open book) |
| Aim: | This unit gives the learner an understanding of the full content of BS 7671, 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

Unit 022

Understand the Requirements for Electrical Installations BS 7671: 2018 (2022)

Supporting Information

Mapping to the ST1017 Domestic Electrician apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

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|------------------|---------------------|-------------|
| 1 | AC1.1 – 1.3 | K1, K7, K8 |
| 2 | AC2.1 – 2.2 | K1, K7, K8 |
| 3 | AC3.1 | K1, K7, K8 |
| 4 | AC4.1 – 4.2 | K1, K7, K8 |
| 5 | AC5.1 – 5.2 | K1, K7, K8 |
| 6 | AC6.1 – 6.2 | K1, K7 |
| 7 | AC7.1 – 7.2 | K1, K7, K14 |
| 8 | AC8.1 – 8.3 | K1, K7 |

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 Level 3 Award in the Requirements for Electrical Installations BS 7671:2018 (2022)
- 5357 Level 3 Electrotechnical Qualification (Installation) (Maintenance)

Please refer to the Electrotechnical Assessment Exemption Guidance document on the City & Guilds website for further information.

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 the **Centre Document Library** on **www.cityandguilds.com** or click on the links below:

Quality Assurance Standards: Centre Handbook

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.

Quality Assurance Standards: Centre Assessment

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, [Contact us](#)

City & Guilds

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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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