Level 3 Advanced Technical Diploma in Electrical Installation (450) (8202-30)

April 2024 Version 1.10

Qualification Handbook

Qualification at a glance

Industry area	Building Service Industries
City & Guilds qualification number	8202-30
Age group	16-18 (Key Stage 5), 19+
Entry requirements	Centres must ensure that any prerequisites stated in the *What is this qualification about?* section are met.
Assessment	To gain this qualification, candidates must successfully achieve the following assessments: • One externally set, externally moderated assignment • One externally set, externally marked exams, sat under examination conditions
Additional requirements to gain this qualification	Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.
Grading	This qualification is graded Pass/Merit/Distinction/Distinction* For more information on grading, please see Section 7: Grading.
Approvals	These qualifications require full centre and qualification approval
Support materials	Sample assessments Guidance for delivery Guidance on use of marking grids
Registration and certification	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.
External quality assurance	This qualification is externally quality assured by City & Guilds, and its internally marked assignments are subject to external moderation. There is no direct claim status available for this qualification.

Title and level	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 3 Advanced Technical Diploma in Electrical Installation (450)	450	720	8202-30	601/7307/5

Version and date	Change detail	Section
May 2016 V1.1	Small typographical errors	Throughout
	TQT added for qualifications Assessment component titles amended	1. Introduction
	Employer involvement guidance updated throughout	4. Employer involvement
	Summary of assessment methods and conditions	5. Assessment
	Moderation and standardisation of assessment updated throughout	6. Moderation and standardisation of assessment
	Awarding individual assessments Awarding grades and reporting results	7. Grading
	Enquiries about results Re-sits and shelf-life of assessment results Malpractice Access arrangements and special consideration	8. Administration
October 2016 V1.2	Test specification	5. Assessment
	Centre staffing	2. Centre requirements
June 2017 V1.3	Addition of the examination paper-based module number	1. Introduction – Assessment requirements and employer involvement 5. Assessment 5. Assessment – Exam specification 7. Grading – Awarding grades and reporting results
	Removal of AO 6-8 from Synoptic Assignments	5. Assessment – Assessment Objectives
	Addition of Provisional Grade Boundaries for the Synoptic Assignment	7. Grading
	Revised Exam Specification, Exam Duration and AO weightings	5. Assessment – Exam Specification
	Branding Changes	Throughout
September 2017 V1.4	AO weightings amended	Assessment
November 2017 V1.5	Component numbers amended (031 removed)	Introduction Assessment Grading

	Assessment description amended	5. Assessment- Summary of assessment methods and conditions
	AO weightings amended	5. Assessment – Exam specification
March 2018 V1.6	Duration amended '2.5 Hours'	5. Assessment – Exam specification
May 2019 V1.7	Wording changed regarding retakes	5. Assessment – Summary of assessment methods and conditions 8. Administration – Re-sits and shelf-life of assessment results
April 2022 V1.8	Clarified permitted assessment materials	5. Assessment
October 2023 V1.9	Additional clarification on exam permitted materials added	5. Assessment
	Minor formatting changes	Throughout
April 2024 V1.10	Update of Quality Assurance Statement	Centre Requirements

Contents

1 Introduction

What is this qualification about?

The following purpose statement relates to the **Level 3 Advanced Technical Diploma in Electrical Installation (450) (601/7307/5)**

Area	Description
OVERVIEW	
Who is this qualification for?	This qualification is for you if you are a 16-19 year old learner, who wishes to work as an electrician in the building services industry. It has been designed to deliver a high level of occupational skills and provide a platform from which to progress through further learning or into employment. This vocational route at level 3 is a vital step towards becoming a competent electrician.
What does this qualification cover?	The qualification will help you gain an understanding of the skills required within the electrotechnical sector. You will cover compulsory aspects such as: • working safely and effectively • design, construct, test and commission electrical systems • methods of supervision • electrical science and principles • regulations and law • diagnose and repair electrical faults. Centres and providers work with local employers who will contribute to the knowledge and delivery of training. Employers will provide demonstrations and talks on the industry and where possible work placements will also be provided by the employers. This practically based training is ideal preparation for gaining employment in the electrotechnical industry or specialist further study.
WHAT COULD THIS QUALIFICATION LEAD TO?	
Will the qualification lead to employment, and if so, in which job role and at what level?	This technical qualification focuses on the development of knowledge and practical skills needed for working in the electrotechnical industry, which will prepare you to enter an electrotechnical apprenticeship programme. On completion of the Apprenticeship, the learner will be recognised by the industry as competent as an installation or maintenance electrician.
Why choose this qualification over similar qualifications?	This qualification is aimed at learners who are not yet employed in the electrotechnical industry but wish to learn the skills needed to progress further, and help them embark on an electrotechnical apprenticeship programme.

Will the qualification lead to further learning?	This qualification will prepare you for an electrotechnical apprenticeship programme, which fully qualifies you to work as an electrician. The apprenticeship will give you an understanding of suitable on-site skills and further knowledge required to work in the electrical industry. Once qualified, there are many further specific and specialised qualifications enhancing skills within the industry, such as electrical design, inspection and testing, appliance safety and environmental technology systems.
WHO SUPPORTS THIS QUALIFICATION?	
Employer/Higher Education Institutions	This qualification is supported by the JIB (Joint Industry Board). The JIB have been at the forefront of maintaining qualifications in electrotechnical industry for over 40 years. This industry qualification is acknowledged by the Electrotechnical Certification Scheme (ECS). The JIB supports the above qualification as being important for employment within the industry.

Qualification structure

For the **Level 3 Advanced Technical Diploma in Electrical Installation (450)** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
Mandatory		
301	Planning and overseeing electrical work activities	60
302	Principles of electrical science	60
303	Electrical design and installation practices and procedures	60
304	Principles of inspection, testing and commissioning electrical systems	60
305	Inspecting, testing and commissioning electrical systems	60
306	Electrical system fault diagnosis and rectification	90
307	Requirements for electrical installations	60
	Total hours	**450**

Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
Level 3 Advanced Technical Diploma in Electrical Installation (450)	450	720

Assessment requirements and employer involvement

To achieve the **Level 3 Advanced Technical Diploma in Electrical Installation (450)** candidates must successfully complete **all** the mandatory assessment components.

Component number	Title
Mandatory	
531	Level 3 Electrical Installation - Theory exam (1)*
032	Level 3 Electrical Installation - Synoptic assignment (1)*

In addition, candidates **must** achieve the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

Employer involvement

Component number	Title
Mandatory	
830	Level 3 Employer involvement - Portfolio

**Number of mandatory assessments per assessment type*

2 Centre requirements

Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' **full** Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: **www.cityandguilds.com**

Resource requirements

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

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following requirements:

- Be occupationally competent at or above the level they are delivering
- Be able to deliver across the breadth and depth of the content of the qualification being taught
- Have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- Demonstrate continuing CPD.

Staff assessing these qualifications must meet the above requirements as well as hold or be working towards 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. Assessors must also hold a relevant trade qualification and/or having registration with a relevant trade organisation as 'Approved tradesperson' status or 'Eng- Tech' status.

Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessment.

Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of tutors and markers. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. All external quality assurance processes reflect the minimum requirements for verified and moderated assessments, as

detailed in the Centre Assessment Standards Scrutiny (CASS), section H2 of Ofqual's General Conditions. For more information on both CASS and City and Guilds Quality Assurance processes visit: the What is CASS? and Quality Assurance Standards documents on the City & Guilds website.

Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

Age restrictions

This qualification is approved for learners aged 16-18, 19+.

3 Delivering technical qualifications

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 learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand 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.

Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

Support materials

The following resources are available for this qualification:

Description	How to access
• Sample assessments • Exam guide • Past assessments materials • Qualification reports • Guidance for delivery • Guidance on use of marking grids	Qualification pages on the City & Guilds Website: **www.cityandguilds.com**

4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and students and furthers collaboration between the learning and skills sector and industry.

[Technical qualifications] must:

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: ***Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90***

City & Guilds will provide support, guidance and quality assurance of employer involvement.

Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planner a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

Types of involvement

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification. This does not mean that employer involvement in the optional units is not valuable, and centres are encouraged to consider this wherever appropriate.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning.

Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows[1,2]:

The following activities meet the requirement for meaningful employer involvement:

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification[3];*
- *students undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.

[1] As extracted from: Vocational qualifications for 16 to 19 year olds
2017 and 2018 performance tables: technical guidance for awarding organisations
[2]This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**
[3] **DfE work experience guidance**

The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*
- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*
- *employers providing students with job references.*

Types of evidence

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. E.g. for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

Quality assurance process

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

Sufficiency of involvement for each learner

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry. Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

Live involvement

Learners will gain most benefit from direct interaction with employers and/or their staff; however the use of technology (eg the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

Timing

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

5 Assessment

Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
531	Externally marked exam	The exam is externally set and externally marked, and will be paper-based only. The exam is designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: **http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations** The exam specification shows the coverage of the exam across the qualification content. Candidates who fail the exam at the first sitting will have a maximum of **two** opportunities to retake. If the candidate fails the exam three times then they will fail the qualification. (Note: the third and final retake opportunity applies to Level 3 only.) For exam dates, please refer to the Assessment and Examination timetable.
032	Synoptic assignment	The synoptic assignment is externally set, internally marked and externally moderated. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives. Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website. Where seasonality is a factor in the timing of the assignment the assignment will be released early to ensure that candidates can take the assignment to fit in with the seasonal requirements. Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method. There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification. Please note that for externally set assignments City & Guilds provides guidance and support to centres on the marking and moderation process.

What is synoptic assessment?

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example, this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high-quality outcome.

How the assignment is synoptic for this qualification

The typical assignment brief could be to inspect and test electrical wiring systems including carrying out required diagnosis and rectification for a range of faults. Candidates will need to draw on skills and understanding developed across the qualification content in order to consider the specific requirements of a system and the related electrical principles before carrying out their tasks. Inspecting, testing and rectifying domestic wiring systems will require the candidate to work safely, follow correct process sequences, select and use tools, equipment and appliances, as well as record work done and hand over to a client.

External exam for stretch, challenge and integration

The external assessments will draw from across the mandatory content of the qualification, using a range of shorter questions to confirm breadth of knowledge and understanding. Extended response questions are included, giving candidates the opportunity to demonstrate higher level understanding and integration through discussion, analysis and evaluation, and ensuring the assessment can differentiate between 'just able' and higher achieving candidates.

Assessment objectives

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including weightings for the synoptic assignments. In some cases, due to the nature of a qualification's content, it is not appropriate to award marks for some AOs. Where this is the case, these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

Assessment objective	Level 3 Advanced Technical Diploma in Electrical Installation (450) Typical expected evidence of knowledge, understanding and skills	Approximate weighting
AO1 Recalls knowledge from across the breadth of the qualification.	Identification of methods, techniques, materials and their properties, document requirements, information required to complete building regulations applications, legislation and regulations, roles and responsibilities, use of terminology.	15%
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Workplace risks assessments, interpretation of diagnostic test results, Explanations/comparisons related to material and component specifications and performance, why and when different methods, techniques, materials are used, principles.	20%
AO3 Demonstrates technical skills from across the breadth of the qualification.	Working in a safe manner, interpreting test results, use of tools and equipment, use of diagnostic equipment.	30%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Examples of bringing it all together: Applying knowledge and understanding to a particular scenario/ problem – justifying decisions/approaches taken e.g. materials, techniques, adapting practice to meet contextual challenges.	20%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Accuracy and detail of drawings, attention to accuracy during work, thinking about and attending to specific requirements of the task, completeness and attention to usability of documentation, attention to detail in risk assessment and risk reduction/method statements.	15%

Permitted materials

Subject	Assessment no.	Assessment type	Assessment time	Permitted materials
Level 3 Theory Test	531	Externally marked, written paper	150 minutes (2.5 hours)	BS 7671*; IET On-site Guide; IET guide to the building regulations
Level 3 Synoptic Assignment	032	Synoptic assignment	Subject to assignment version	Any relevant resource

*This document **must** be made available to candidates during the exam. Refer to the 'Electrotechnical permitted reference materials' guide for more information.

Exam specification

AO weightings per Exam

AO	Test 531 weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	36
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	44
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20

The way the exam covers the content of the qualification is laid out in the table below:

Assessment type: Examiner marked, written exam, delivered on paper*
Assessment conditions: Invigilated examination conditions, see previous page for permitted materials
Grading: X/P/M/D

531	Duration: 2.5 hours		
Unit	**Outcome**	**Number of marks**	**%**
301	Planning and overseeing electrical work activities	3	4
302	Principles of electrical science	21	28
303	Design and installation practices and procedures	9	12
304	Principles of inspection, testing and commissioning electrical systems	9	12
305	Inspecting, testing and commissioning electrical systems**	N/A	N/A
306	Electrical system fault diagnosis and rectification	6	8
307	Requirements for electrical installations	12	16
N/A	Integration across units	15	20
	Total	**75**	**100**

*These exams are sat under invigilated examination conditions, as defined by the JCQ:
http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations

**This unit will be solely assessed as part of the synoptic assignment.

Entry for exams can be made through the City & Guilds Walled Garden.

6 Moderation and standardisation of assessment

City & Guilds' externally set assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation. This process is outlined below. For more detailed information, please refer to 'Marking and moderation - Technicals centre guidance' available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

Supervision and authentication of internally assessed work

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

Internal standardisation

For internally marked work[4] the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

Provision for reworking evidence after submission for marking by the tutor

It is expected that in many cases a candidate who is struggling with a specific piece of work may themselves choose to restart and rectify the situation during their normal allocated time, and before it gets to the stage of it being handed in for final marking by the tutor.

In exceptional circumstances however, where a candidate has completed the assignment in the required timescales, and has handed it in for marking by the tutor but is judged to have significantly underperformed, may be allowed to rework or supplement their original evidence for remarking prior to submission for moderation. For this to be allowed, the centre must be confident that the candidate will be able to improve their performance without additional feedback from their tutor and within the required timescales i.e., the candidate has shown they can perform sufficiently better previously in formative assessments.

The reworked and/or supplemented original evidence must be remarked by the tutor in advance of the original moderation deadline and the moderator informed of any candidates who have been allowed to resubmit evidence.

The process must be managed through the IQA. The justification for allowing a resubmission should be recorded and made available on request. The use of this provision will be monitored by City & Guilds.

[4] For any internally assessed optional unit assignments, the same process must be followed where assessors must standardise their interpretation of the assessment and grading criteria.

Internal appeal

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, i.e., the synoptic assignment and any optional unit assignments. This must take place before the submission of marks for moderation. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

Centres cannot appeal the outcome of moderation for individual candidates, only the moderation process itself. A request for a review of the moderation process should be made to **appeals@cityandguilds.com**.

Moderation

Moderation is the process where external markers are standardised to a national standard in order to review centre marking of internally marked assessments. These markers are referred to as 'moderators'. Moderators will mark a representative sample of candidates' work from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria correctly, centre marks for the whole cohort will be accepted.

Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment will be made to the marks of the whole cohort, retaining the centre's rank ordering.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances, a complete remark of the candidate work may be necessary. This may be carried out by the centre based on feedback provided by the moderator, or carried out by the moderator directly.

Moderation applies to all internally marked assignments. Following standardisation and marking, the centre submits all marks and candidate work to City & Guilds via the moderation platform. The deadline for submission of evidence will be available on Walled Garden. See the *Marking and moderation - Technicals Centre Guidance* document for full details of the requirements and process.

In most cases candidate work will be submitted directly to the moderator for moderation. This includes written work, photographic and pictorial evidence, or video and audio evidence. For some qualifications there will be a requirement for moderators to visit centres to observe practical assessments being undertaken. This will be for qualifications where the assessment of essential learner skills can only be demonstrated through live observation. The purpose of these visits is to ensure that the centre is assessing the practical skills to the required standards, and to provide the moderators with additional evidence to be used during moderation. These visits will be planned in advance with the centre for all relevant qualifications.

Post-moderation procedures

Once the moderation process has been completed, the confirmed marks for the cohort are provided to the centre along with feedback from the moderator on the standard of marking at the centre, highlighting areas of good practice, and potential areas for improvement. This will inform future marking and internal standardisation activities.

City & Guilds will then carry out awarding, the process by which grade boundaries are set with reference to the candidate evidence available on the platform.

Centres retaining evidence

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

7 Grading

Awarding individual assessments

Individual assessments will be graded, by City & Guilds, as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (e.g., archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the Merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the Merit grade for the qualification overall.

Grade descriptors

To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work-related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.

- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan, that would credibly achieve an outcome that is highly fit for purpose.
- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The **Level 3 Advanced Technical Diploma in Electrical Installation** will be reported on a four-grade scale: Pass, Merit, Distinction, Distinction*.

All assessments **must** be achieved at a minimum of Pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade Pass for an assessment(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundary(ies) for the synoptic assignment(s) in this qualification are:

Synoptic Assignment	Pass Mark (%)
032	38

The contribution of assessments towards the overall qualification grade is as follows:

Assessment method	Grade scale	% contribution
Synoptic Assignment (032)	X/P/M/D	60%
Exam (531)	X/P/M/D	40%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. A range of points between the Pass, Merit and Distinction boundaries will be accessible to candidates. For example, a candidate that achieves a middle to high Pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle Merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

	Pass	Merit	Distinction
Synoptic Assignment: 60%	6	12	18
Theory Exam 1: 40%	6	12	18

The candidate's points for each assessment are multiplied by the % contribution of the assessment and then aggregated. The minimum points required for each qualification grade are as follows:

Qualification Grade	Points
Distinction*	20.5
Distinction	17
Merit	11
Pass	6

Candidates achieving Distinction* will be the highest achieving of the Distinction candidates.

8 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation.

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

External quality assurance

City & Guilds will undertake external moderation activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to:

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make secure arrangements to receive, check and keep assessment material secure at all times,
- maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and
- keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for internally marked assessments.

For further details on enquiries and appeals process and for copies of the application forms, please visit the **appeals page** of the City & Guilds website at **www.cityandguilds.com.**

Re-sits and shelf-life of assessment results

Candidates who have failed an exam or wish to re-take it in an attempt to improve their grade, can do so **twice**.

The best result will count towards the final qualification. See guidance on individual assessment types in Section 5.

Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (e.g., disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*.

Access arrangements and special consideration

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge

without changing the demands of the assessment. These arrangements must be made before assessment takes place.

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

Please refer to the *JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds* for more information. Both are available on the City & Guilds website: **http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments**

Special consideration
We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, *A guide to the special consideration process*. This document is available on the City & Guilds website: **http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments**

Unit 301 Planning and overseeing electrical work activities

UAN:	L/507/3794
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop the knowledge and understanding required to plan and oversee electrical work activities. Successful working in electrical installation and building services generally requires good communication and organisational skills. Careful planning is key to delivering effective and quality electrical installations whilst maintaining safety and delivering services on time to meet client expectations.

The unit covers communication techniques and ways of working with others, the industry recognised standards for planning and running electrical installations including schedules and work programmes. Learner will also cover potential issues that can arise when overseeing electrical installation activities, how to deal with them and how to avoid them.

Learners should consider the following questions as a starting point to this unit:

- What different groups of people are involved in electrical installation activities?
- What different methods of planning work activities are there?
- How can potential delays in electrical work activities be avoided?

Learning outcomes

In this unit, learners will:

1. understand the requirements for liaising with others when organising and overseeing work activities
2. understand the requirements for organising and overseeing work programmes
3. understand the requirements for organising the provision and storage of resources required for work activities

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Understand the requirements for liaising with others when organising and overseeing work activities

- **Topic 1.1:** Communication techniques
- **Topic 1.2:** Determining competence
- **Topic 1.3:** Rescheduling work
- **Topic 1.4:** Documentation for work operations

Topic 1.1

Learners will describe techniques for the communication for different purposes including:

- motivation
- instruction
- monitoring
- co-operation and teamwork.

Learners will cover the communication requirements for different types of people including:

- customers
- clients
- site managers
- major contractors (where appropriate)
- sub-contractors (where appropriate)
- other services
- the public
- employers.

Topic 1.2

Learners will describe methods of determining the competence of operatives for whom they are responsible including:

- checking competency cards (e.g. CSCS cards, JIB cards)
- checking technical qualifications
- written references from previous employers
- informal monitoring of performance on site
- competent person scheme registration.

Topic 1.3

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

Topic 1.4

Learners will specify organisational procedures for completing the documentation that is required during work operations.

Learning outcome 2: Understand the requirements for organising and overseeing work programmes

- **Topic 2.1:** Planning work programmes
- **Topic 2.2:** Carrying out work activities
- **Topic 2.3:** Industry standards
- **Topic 2.4:** Estimating work times
- **Topic 2.5:** Consequences of problems

Topic 2.1

Learners will describe how to plan and implement work programs with consideration of:

- work allocations
- duties of operative for whom they are responsible
- coordination with other services and personnel.

Learners will be taught how to specify and evaluate methods of producing and illustrating work programmes including:

- bar charts
- spreadsheets
- critical path analysis.

Learners will evaluate within the scope of the work programme and operations the responsibilities of themselves and others.

Topic 2.2

Learners will describe the procedures for carrying out work activities with consideration of:

- maintaining the safety of the work environment
- maintaining cost effectiveness
- ensuring compliance with the programmes of work.

Learners will identify procedures for dealing with changes to an original contract specifications including:

- variation order
- day work sheets
- implications to work programme.

Topic 2.3

Learners will know the industry standards that are relevant to activities carried out during the installation of electrical systems and equipment, including the current editions:

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

Learners will identify installations that require specialist advice or guidance including:

- hazardous installations
- installations outside the scope of BS 7671.

Topic 2.4

Learners will explain how work completion times are estimated, taking into account influential factors such as:

- 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.

Topic 2.5

Learners will know the potential consequences of problems during scheduling including:

- not completing work within the estimated time
- not meeting the requirements of the programme of work
- not using the specified materials
- not installing materials and equipment as specified.

Learning outcome 3: Understand the requirements for organising the provision and storage of resources required for work activities

- **Topic 3.1:** Installation specifications and work programmes
- **Topic 3.2:** Interpreting material schedules
- **Topic 3.3:** Storage and transportation requirements
- **Topic 3.4:** Safe and effective storage

Topic 3.1

Learners will interpret installation specifications and work programme to identify requirements for resources including:

- materials
- components
- plant
- vehicles
- equipment
- labour
- tools
- measuring and test instruments.

Topic 3.2

Learners will interpret material schedules to confirm that materials available are correct with consideration that they are:

- the right type
- fit for purpose
- in the correct quantity
- suitable for work to be completed cost efficiently.

Topic 3.3

Learners will be taught how to specify the storage and transportation requirements for all materials required in work locations.

Topic 3.4

Learners will be taught how to specify procedures to ensure the safe and effective storage of materials, tools and equipment in work locations.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 302 Principles of electrical science

UAN:	R/507/3795
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop an understanding of the principles of electrical science related to electrical installation including AC theory, machines, devices and systems. This understanding is applied when designing wiring systems to meet client requirements and as well as part of fault diagnosis and rectification.

The unit covers the characteristics of different electrical supply systems, how electrical properties impact on electrical installations, operating principles of key electrical components used in building service engineering as well as the principles and applications of current heating and lighting systems.

Learners should consider the following questions as a starting point to this unit:

- How is electricity stored and transported?
- How is electrical current and power calculated?
- What different components make up heating and lighting systems?

Learning outcomes

In this unit, learners will:

1. understand electrical supply systems
2. understand how electrical properties affect electrical circuits, systems and equipment
3. understand the operating principles and applications of D.C. machines, A.C. motors and electrical components
4. understand the principles and applications of electrical lighting systems
5. understand the principles and applications of electrical heating

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Understand electrical supply systems

- **Topic 1.1:** Electricity generation and transmission
- **Topic 1.2:** Other sources of electricity
- **Topic 1.3:** Electrical supplies
- **Topic 1.4:** Transformers
- **Topic 1.5:** Calculating and measuring electricity

Topic 1.1

Learners will describe how electricity is generated and transmitted for domestic and industrial/commercial consumption. Learners will also specify the features and characteristics of generation and transmission systems with consideration of:

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

Topic 1.2

Learners will understand the basic operating principles of other sources of electricity including:

- batteries, cells or UPS systems
- solar power (thermal and photovoltaic)
- wind energy
- wave energy
- micro hydro
- combined heat and power (CHP) including micro CHP.

Topic 1.3

Learners will describe the main characteristics of electrical supply systems including:

- single phase electrical supplies
- three phase electrical supplies
- three phase and neutral supplies
- sub-station transformers.

Topic 1.4

Learners will know the different types of transformers and describe the operating principles, applications and limitations of transformers with consideration of:

- iron loss

- copper loss
- relationship between current and voltage
- primary and secondary windings
- step-up and step-down transformers.

Topic 1.5

Learners will determine electricity by calculation and measurement including:

- primary and secondary voltages
- primary and secondary current
- kVA rating of a transformer.

Learning outcome 2: Understand how different electrical properties can affect electrical circuits, systems and equipment

- **Topic 2.1:** Electrical relationships
- **Topic 2.2:** Alternating current circuits
- **Topic 2.3:** Power factor
- **Topic 2.4:** Calculating voltage and current

Topic 2.1

Learners will explain the relationship between resistance, inductance, capacitance and impedance. Learners will also explain the relationship between kW, kVAr, kVA and power factor.

Topic 2.2

Learners will determine electrical quantities in alternating currents with consideration of:

- resistance
- inductance
- inductive reactance
- capacitance
- capacitive reactance
- impedance.

Topic 2.3

Learners will calculate power factor, explain what is meant by power factor correction and specify methods of power factor correction.

Topic 2.4

Learners will determine the neutral current in a three-phase and neutral supply and why systems should be balanced. Learners will also calculate values of voltage and current in star and delta connected systems.

Learning outcome 3: Understand the operating principles and applications of D.C. machines, A.C. motors and electrical components

- **Topic 3.1:** D.C. machines
- **Topic 3.2:** A.C. motors
- **Topic 3.3:** Motor control
- **Topic 3.4:** Electrical components

Topic 3.1

Learners will state the basic types, applications and describe the operating principles of d.c. machines including:

- series
- shunt
- compound.

Topic 3.2

Learners will describe the operating principles of a.c. motors and state the basic types, applications and limitations of them:

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

Topic 3.3

Learners will describe the basic operating principles, limitations and applications of motor control including:

- direct-on-line
- star-delta
- rotor-resistance
- soft-start
- variable frequency.

Topic 3.4

Learners will specify the main types and operating principles of electrical components including:

- contactors
- relays
- solenoids
- over-current protection devices:
    - Fuses (HRC, cartridge and re-wireable)
    - Circuit-breakers
    - RCBOs
- RCDs.

Learning outcome 4: Understand the principles and applications of electrical lighting systems

- **Topic 4.1:** Principles of illumination
- **Topic 4.2:** Luminaires

Topic 4.1

Learners will explain the basic principles of illumination and state the applications of related laws and methods including:

- inverse square law
- cosine law
- lumen method.

Topic 4.2

Learners will explain the operating principles, types, limitations and applications of luminaires including:

- General Lighting Service (GLS):
  - tungsten
  - halogen.
- discharge lighting:
  - low and high pressure mercury vapour
  - low and high pressure sodium vapour
  - metal halide.
- energy saving (such as compact fluorescent lamps)
- LEDs.

Learning outcome 5: Understand the principles and applications of electrical heating

- **Topic 5.1:** Principles of electrical heating
- **Topic 5.2:** Electrical heating appliances and components

Topic 5.1

Learners will explain the basic principles of electrical space heating and electrical water heating including:

- convection cycle
- conduction
- radiation.

Topic 5.2

Learners will explain the operating principles, types, limitations and applications of electrical space and water heating appliances and components including:

- immersion heaters
- storage heaters
- convector heaters
- under floor heating
- controls, timers and programmers for heating systems.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 303 Electrical design and installation practices and procedures

UAN:	Y/507/3796
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop the knowledge and understanding required to be able to design electrical systems for installation. Planning effective electrical installations for important for meeting client and industry requirements for new builds and renovation projects.

The unit covers design procedures for electrical systems and circuits, earthing and protecting against overcurrent as well as the characteristics of the wide range of equipment used in supply systems. Learners will cover the fundamental principles to ensure electrical systems are designed and installed safely and efficiently.

Learners should consider the following questions as a starting point to this unit:

- Why is it important to project against overcurrent?
- What is purpose of earthing and protective conductors in systems?
- What different types of circuit should be considered when designing installations?

Learning outcomes

In this unit, learners will:

1. understand the characteristics and applications of supply systems and consumer's equipment
2. understand earthing and protection
3. understand protection against overcurrent
4. understand electrical systems and circuits
5. understand the electrical design procedure

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Understand the characteristics and applications of supply systems and consumer's equipment

- **Topic 1.1:** Earthing arrangements
- **Topic 1.2:** Supply systems
- **Topic 1.3:** Installation protection

Topic 1.1

Learners will explain the characteristics and applications of earthing arrangements including:

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

Topic 1.2

Learners will explain the characteristics and applications of supply systems including:

- single phase
- three phase
- three phase and neutral.

Topic 1.3

Learners will specify the arrangements for electrical installations and systems with regard to provision including:

- isolation and switching
- overcurrent protection
- earth fault protection.

Learning outcome 2: Understand earthing and protection

- **Topic 2.1:** Earthing
- **Topic 2.2:** Conductors
- **Topic 2.3:** Protection against electric shock

Topic 2.1

Learners will explain the purpose of earthing and protective conductors.
Learners will also explain the earth fault loop path and earth fault loop impedance and specify requirements and applications of functional earthing.

Topic 2.2

Learners will identify extraneous and exposed conductive parts and select suitably sized protective conductors in accordance with BS 7671.

Topic 2.3

Learners will describe the requirements and measures for protection against electric shock.
Learners will also state the maximum disconnection time for different types of circuit.

Learning outcome 3: Understand protection against overcurrent

- **Topic 3.1:** Overcurrent
- **Topic 3.2:** Protective devices
- **Topic 3.3:** Fault current capacities

Topic 3.1

Learners will identify types of and reasons for overcurrent including:

- short circuits
- earth faults
- overloads.

Topic 3.2

Learners will explain the operating principles, applications and limitations of protective devices including:

- fuses
- CBs
- RCDs/RCBOs, circuit overload and short-circuit protection
- BS3036, BS1362, BS88.

Learners will also outline the need for discrimination between protective devices.

Topic 3.3

Learners will identify fault current capacities of devices including:

- BS 3036
- BS 88-2
- BS 88-3
- BS EN 60898
- BS EN 61009.

Learning outcome 4: Understand electrical systems and circuits

- **Topic 4.1:** Electrical circuits
- **Topic 4.2:** Electrical systems

Topic 4.1

Learners will describe the characteristics of standard electrical circuits including:

- lighting circuits
- socket outlet circuits
- supplies to fixed equipment.

Topic 4.2

Learners will outline the key characteristics of particular electrical systems and circuits and the applications of these circuits and systems including:

- distribution systems (sub mains)
- environmental control/building energy management systems
- emergency Lighting
- security systems – fire alarm/prevention, unlawful entry, emergency lighting
- UPS
- closed circuit TV, communication and data transmission systems

- machine control
- heating control.

Learning outcome 5: Understand electrical design procedures

- **Topic 5.1:** Diversity factors
- **Topic 5.2:** Design currents
- **Topic 5.3:** Suitability ratings
- **Topic 5.4:** Installation method reference
- **Topic 5.5:** Determining rating factors
- **Topic 5.6:** Cross-sectional area of conductors
- **Topic 5.7:** Voltage drop
- **Topic 5.8:** Evaluating thermal constraints

Topic 5.1
Learners will state the purpose of diversity factors and determine the maximum demand (of an installation) after the application of diversity.

Topic 5.2
Learners will determine appropriate design current for single-phase and three-phase circuits.

Topic 5.3
Learners will select suitably ratings of protective devices.

Topic 5.4
Learners will establish the installation method reference.

Topic 5.5
Learners will determine appropriate rating factors from BS 7671.

Topic 5.6
Learners will determine the minimum cross-sectional area of live conductors taking into consideration current carrying capacity and voltage drop.

Topic 5.7
Learners will establish if voltage drop is acceptable.

Topic 5.8
Learners will verify if the disconnection times have been achieved and evaluate thermal constraints.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 304 Principles of inspection, testing and commissioning electrical systems

UAN:	D/507/3797
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop the knowledge and understanding required before carrying out inspection, testing and commissioning on electrical systems to the required industry standard. Learners will explore the requirements, steps and safety considerations at each stage of inspection, testing and commissioning.

The unit covers the requirements for inspection of electrical circuits, safe testing on both energised and non energised circuits and commissioning of electrical installations as well as the industry and legislative standards for completing certification and associated documentation.

Learners should consider the following questions as a starting point to this unit:

- What is safe-isolation of an electrical circuit?
- What different types of tests are there for electrical systems?
- Where are documents completed following electrical installations stored?

Learning outcomes

In this unit, learners will:

1. understand the requirements safe isolation and inspection of electrical circuits
2. understand the requirements for safe testing and commissioning of electrical installations and testing before circuits are energised
3. understand the requirements for testing energised installations
4. understand the requirements for the completion of electrical installation certificates and associated documentation

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Understand the requirements safe isolation and inspection of electrical circuits

- **Topic 1.1:** Electricity at Work requirements
- **Topic 1.2:** Safe isolation
- **Topic 1.3:** Health and Safety requirements
- **Topic 1.4:** Initial verification of electrical installations
- **Topic 1.5:** Items checked during inspection
- **Topic 1.6:** Senses used during inspection
- **Topic 1.7:** Requirements of electrical installations

Topic 1.1

Learners will understand the requirements of the Electricity at Work Regulations for the safe inspection of electrical systems and equipment in terms of:

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

Topic 1.2

Learners will state the reasons for carrying out safe isolation in relation to:

- the inspector
- other personnel
- customers/clients
- public
- building systems.

Learners will demonstrate the appropriate procedure for completing safe isolation including 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.

Learners will also outline the implications of carrying out and not carrying out safe isolation in relation to:

- the inspector
- other personnel
- customers/clients
- public
- building systems (removal of supply).

Topic 1.3

Learners will identify the Health and Safety requirements which apply when inspecting, testing and commissioning electrical installations and circuits including:

- 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.

Topic 1.4

Learners will state the purpose and requirements of initial verification of electrical installations.

Learners will also identify relevant documents associated with the inspection, testing and commissioning of an electrical installation and specify the information that is required by the inspector to conduct the initial verification of an electrical installation.

Documentation including:

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

Topic 1.5

Learners will know the appropriate items from the inspection schedule to be checked during the inspection process.

Topic 1.6

Learners will identify how senses can be used in the inspection process including:

- sight
- touch
- hearing
- smell.

Topic 1.7

Learners will specify the requirements for the inspection of electrical installations including:

- earthing conductors
- earth electrodes
- circuit protective conductors
- main and supplementary protective bonding conductors
- devices for isolation and switching
- type and rating of overcurrent protective devices
- type and rating of RCDs and RCBOs
- barriers and enclosures
- containment systems (steel and plastic)
- cables
- conductors and terminations
- electrical accessories.

Learners will also specify the requirements for inspection to include:

- special installations and locations as identified in Part 7 of BS 7671
- IP Classification of equipment.

Learning outcome 2: Understand the requirements for safe testing and commissioning of electrical installations and testing before circuits are energised

- **Topic 2.1:** Tests carried out
- **Topic 2.2:** Test instruments
- **Topic 2.3:** Test results
- **Topic 2.4:** Verifying continuity
- **Topic 2.5:** Insulation resistance
- **Topic 2.5:** Verifying polarity

Topic 2.1

Learners will state the tests to be carried out on an electrical installation in accordance with the BS 7671 and IET Guidance Note 3 and explain why testing is carried out in the sequence specified.

Topic 2.2

Learners will identify the appropriate instrument for each test to be carried out in terms of:

- the instrument is fit for purpose
- identifying the correct scale or setting.

Learners will also specify the requirements for the safe use of instruments to be used for testing and commissioning, to include:

- checks required to prove that test instruments are safe and functioning correctly
- the requirements for test leads and probes must comply with HSE Guidance GS38
- the need for instruments to be regularly checked and calibrated.

Topic 2.3

Learners will explain why it is necessary for test results to comply with standard values and state the actions to be taken in the event of unsatisfactory results being obtained.

Topic 2.4

Learners will state why it is necessary to verify continuity with consideration of:

- protective bonding conductors
- circuit protective conductors
- ring final circuit conductors.

Learners will also state the methods for verifying continuity including:

- protective conductors
- ring final circuit conductors.

Topic 2.5

Learners will explain factors that affect conductor resistance values including:

- cables connected in parallel
- variations in cable length
- variations in conductor cross sectional area.

Learners will also specify procedures for completing insulation resistance testing including:

- 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.

Learners will state the effects on insulation resistance values that the following can have:

- cables connected in parallel
- variations in cable length.

Topic 2.6

Learners will explain why it is necessary to verify polarity and outline how it can be confirmed.

Learning outcome 3: Understand the requirements for testing energised installations

- **Topic 3.1:** Confirming polarity and measuring earth electrode resistance
- **Topic 3.2:** Earth fault loop paths and verifying protection
- **Topic 3.3:** Measurement of prospective fault current
- **Topic 3.4:** Verifying phase sequence
- **Topic 3.5:** Functional testing
- **Topic 3.6:** Dealing with clients

Topic 3.1

Learners will state the procedures for confirming polarity of the incoming supply and specify the methods for measuring earth electrode resistance to include:

- installations forming part of a TT system
- generators and transformers.

Topic 3.2

Learners will describe common earth fault loop paths with consideration of:

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

Learners will also state methods for verifying protection by automatic disconnection of supply including:

- the measurement of the external earth fault loop impedance (Ze) and the system earth fault loop
- impedance (Zs)
- establishing Ze by enquiry
- calculation of the value of Zs from given information
- comparing measured Zs values with the maximum tabulated figures as specified in BS 7671 including the application of the correction factor.

Topic 3.3

Learners will identify the requirements for the measurement of prospective fault current including:

- specify the methods for determining prospective fault current (Single phase installations and three phase installations)

- verify the suitability of protective devices for prospective fault currents
- specify the methods for testing the correct operation of residual current devices.

Topic 3.4

Learners will state the reason for verifying phase sequence and the methods used.

Topic 3.5

Learners will state the need for functional testing and identify items which require functional testing including:

- switches
- circuit protection
- isolators.

Topic 3.6

Learners will state the appropriate procedures for dealing with clients during the commissioning and certification process with consideration of:

- 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 4: Understand the requirements for the completion of electrical installation certificates and associated documentation

- Topic 4.1: Certification documentation
- Topic 4.2: Verification documentation

Topic 4.1

Learners will explain the purpose of certification and associated documentation including:

- an electrical installation certificate
- a minor electrical installation works certificate
- schedule of inspections
- schedule of test results.

Learner will also describe the certification process for a completed installation and identify the responsibilities of different relevant personnel in relation to the completion of the certification process.

Topic 4.2

Learners will state the information that must be contained on initial verification documentation and explain the requirements for the recording and retention of completed initial verification documentation in accordance with the BS 7671.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 305 Inspecting, testing and commissioning electrical systems

UAN:	H/507/3798
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to build on the theoretical principles and develop the practical skills required for actually carrying out inspections, testing and commissioning on electrical systems to meet industry standards and client requirements. Learners will have the opportunity of hands-on interaction with electrical system inspection and testing equipment.

The unit covers the practical elements of checking electrical systems prior to inspection, carrying out inspections and testing on installations, followed by the actual commissioning of electrical systems and equipment.

Learners should consider the following questions as a starting point to this unit:

- Which safety checks are carried out prior to inspection?
- What test instruments are used on electrical installations?
- What steps can be taken to ensure a safe system of work is established?

Learning outcomes

In this unit, learners will:

1. confirm safety of system and equipment prior to completion of inspection, testing and commissioning
2. carry out inspection of electrical installations prior to them being placed into service
3. test electrical installations prior to them being placed into service
4. commission electrical systems and equipment

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Confirm safety of system and equipment prior to completion of inspection, testing and commissioning

- **Topic 1.1:** Safe isolation procedure
- **Topic 1.2:** Health and safety requirements
- **Topic 1.3:** Checking safety of systems

Topic 1.1

Learners will carry out safe isolation procedure in accordance with regulatory and industry practices.

Topic 1.2

Learners will comply with the health and safety requirements of themselves and others within the work location during the initial verifications process.

Topic 1.3

Learners will check the safety of the electrical system prior to the commencement of inspection, testing and commissioning.

Learning outcome 2: Carry out inspection of electrical installations prior to them being placed into service

- **Topic 2.1:** Safe systems of work
- **Topic 2.2:** Initial inspections
- **Topic 2.3:** Completing a schedule of inspections

Topic 2.1

Learners will identify and follow a safe system of work appropriate to the work activity.

Topic 2.2

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

Topic 2.3

Learners will 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 3: Test electrical installations prior to them being placed into service

- **Topic 3.1:** Selecting test instruments
- **Topic 3.2:** Carrying out tests
- **Topic 3.3:** Confirming compliance
- **Topic 3.4:** Completing documentation

Topic 3.1

Learners will select test instruments and their accessories for tests to include:

- continuity
- insulation resistance
- polarity
- earth electrode resistance
- earth fault loop impedance
- prospective fault current
- RCD operation
- phase sequence
- functional testing.

Learners will evaluate the appropriate tests suitable for the installation to be verified.

Topic 3.2

Learners will carry out tests in accordance with BS 7671, IET On-site Guide and Guidance notes 3 to include:

- continuity including:
    - main protective bonding conductors
    - circuit protective conductors
    - ring final circuits.
- insulation resistance
- polarity
- external earth fault loop impedance (Ze)
- system earth fault loop impedance (Zs)
- prospective fault current
- RCD operation including additional protection
- phase sequence
- functional testing.

Topic 3.3

Learners will confirm compliance by evaluating and verifying test results.

Topic 3.4

Learners will complete appropriate documentation in accordance with the BS 7671 and IET Guidance Note 3 including:

- electrical installation certificate
- schedule of inspections
- schedule of test results.

Learning outcome 4: Commission electrical systems and equipment

- **Topic 4.1:** Clarifying procedures
- **Topic 4.2:** Commissioning

Topic 4.1

Learners will clarify the commissioning procedure with relevant persons.

Topic 4.2

Learners will carry out the commissioning of circuits, accessories and equipment to confirm functionality including:

- single phase
- three phase
- lighting
- radical power
- ring power.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 306 Electrical system fault diagnosis and rectification

UAN:	K/507/3799
Level:	3
GLH:	90

What is this unit about?

The purpose of this unit is for learners to develop knowledge and understanding required to identify, diagnose and rectify common faults in electrical systems installations. Learners will also have the opportunity to develop their practical skills in performing diagnosis on faults in electrical installations.

The unit covers different types of electrical faults that can affect installations, procedures for diagnosing faults in systems and techniques for correcting faults. Learners will also consider the health and safety considerations impacting on fault diagnosis in electrical systems.

Learners should consider the following questions as a starting point to this unit:

- How are faults in electrical installations recorded?
- What are the common cause of electrical faults in systems?
- What tools and equipment can be used for fault diagnosis?

Learning outcomes

In this unit, learners will:

1. understand the health and safety requirements relevant to fault diagnosis
2. understand the importance of reporting and communication in fault diagnosis
3. understand the nature and characteristics of electrical faults
4. understand the fault diagnosis procedure
5. understand the procedures and techniques for correcting electrical faults
6. perform fault diagnosis.

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning Outcome 1: Understand the health and safety requirements relevant to fault diagnosis

- **Topic 1.1:** Dangers of electricity
- **Topic 1.2:** Health and safety requirements
- **Topic 1.3:** Safe working procedures

Topic 1.1

Learners will state the dangers of electricity in relation to fault diagnosis work.

Topic 1.2

Learners will identify the health and safety requirements relevant to diagnosing and correcting electrical faults in electrical systems and equipment including:

- 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.

Topic 1.3

Learners will specify safe working procedures that should be adopted for completion of fault diagnosis and correction work including:

- effective communication with others ie people on the premises, customers etc.
- use of barriers
- positioning of notices
- safe isolation
- use of equipment to GS 38.

Learning Outcome 2: Understand the importance of reporting and communication in fault diagnosis

Topic 2.1: Fault diagnosis documentation

Topic 2.2: Implications of fault diagnosis

Topic 2.3: Communication requirements

Topic 2.1

Learners will describe documentation relevant to fault diagnosis including:

- operation manuals
- certificates and reports
- fault reports
- manufacturers' information.

Topic 2.2

Learners will state the implications of fault diagnosis for customers and clients including:

- loss of circuits
- equipment.

Topic 2.3

Learners will explain the communication requirements relevant to fault diagnosis including:

- informing relevant persons about information on electrical fault diagnosis and correction work
- why it is important to provide relevant persons with information on fault diagnosis and correction work clearly, courteously and accurately
- explain why relevant people need to be kept informed during completion of fault correction work:
    - other workers/colleagues
    - customers/clients
    - representatives of other services.

Learning Outcome 3: Understand the nature and characteristics of electrical faults

- **Topic 3.1:** Types of faults
- **Topic 3.2:** Locations of faults

Topic 3.1

Learners will identify types, causes and consequences of electrical faults including:

- loss of supply
- low voltage/voltage drop
- component/equipment malfunction/failure
- operation of overload or fault current devices
- arcing - loose connection
- high resistance - loose connection
- transient voltages - lighting strike
- excess current - overload
- insulation failure - deterioration, mechanical damage:
    - short-circuit
    - open circuit
    - earth fault
- signal faults.

Topic 3.2

Learners will describe typical types of faults and their likely locations in wiring systems and equipment including:

- wiring systems
- terminations and connections
- equipment/accessories (switches, luminaires, switchgear and control equipment)
- instrumentation/metering.

Learning Outcome 4: Understand the fault diagnosis procedure

- **Topic 4.1:** Precautions
- **Topic 4.2:** Fault diagnosis
- **Topic 4.3:** Test instruments
- **Topic 4.4:** Analysing test results

Topic 4.1

Learners will state precautions that must be taken when carrying out fault diagnosis with regard to particular locations, equipment and circumstances including:

- lone working
- hazardous areas
- fibre-optic cabling
- electro-static discharge (friction, induction, separation)
- electronic devices (damage by over voltage)
- IT equipment (e.g. shutdown, damage)
- high frequency or capacitive circuits
- presence of batteries (e.g. lead acid cells, connecting cells)
- additional sources of energy
- time controlled devices.

Topic 4.2

Learners will specify an appropriate and logical procedures for fault diagnosis and carrying out fault diagnosis tests including stages:

- identification of symptoms
- collection and analysis of data
- use of sources/types of information such as BS 7671, Certificates/Reports, Installation Specifications, drawings/diagrams, manufacturer's information and operating instructions
- maintenance records
- experience (personal and of others) i.e. speaking to operators/customers to determine nature/characteristics of the fault
- checking and testing (e.g. supply, protective devices)
- interpreting results/information
- fault correction
- functional testing
- restoration
- all live test equipment in accordance with HSE guidance document GS 38.

Tests to include:

- continuity
- insulation resistance
- polarity
- earth fault loop impedance
- RCD operation
- current and voltage measurement
- phase sequence
- functional testing/checking.

Topic 4.3

Learners will select the appropriate test instrument/s for fault diagnosis work and describe how test instruments are confirmed to be fit for purpose and functioning correctly including for:

- voltage indicator
- low resistance ohm meter
- insulation resistance testers
- EFLI and PFC tester
- RCD tester

- tong tester/clamp on ammeter
- phase sequence tester.

Topic 4.4
Learners will analyse and determine if test results are acceptable.

Learning Outcome 5: Understand the procedures and techniques for correcting electrical faults

- **Topic 5.1:** Factors affecting repair or replacement
- **Topic 5.2:** Verifying fault correction
- **Topic 5.3:** Safe disposal of waste

Topic 5.1
Learners will identify factors which can affect repair or replacement of equipment including:

- cost
- availability of replacement parts, resources and staff
- down time (planning)
- legal and personal responsibility (e.g. contracts, warranties, relevant personnel)
- access to systems and equipment
- provision of emergency or stand by supplies
- client demand (continuous supply, out of hours working).

Topic 5.2
Learners will specify the procedures for verifying that the fault has been corrected suitable for the situation using technical analysis including:

- functional testing/checking
- continuity
- insulation resistance
- polarity
- earth fault loop impedance
- RCD operation
- current and voltage measurement/ checking presence of supply
- phase sequencing.

Topic 5.3
Learners will describe methods used to ensure the safe disposal of any waste and that the work area is left in a safe and clean condition including:

- WEEE
- local authority requirements
- recycling
- landfill
- hazardous materials.

Learning Outcome 6: Perform fault diagnosis

Topic 6.1: Fault diagnosis
Topic 6.2: Evaluation of symptoms
Topic 6.3: Recommending corrective action

Topic 6.1

Learners will evaluate and apply appropriate fault diagnosis methods and techniques including:

- 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.

Topic 6.2

Learners will determine and follow correct safe working procedures to diagnose electrical faults using engineering decision and evaluation of symptoms and findings.

Topic 6.3

Learners will recommend appropriate action/s to correct fault(s).

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Unit 307 Requirements for electrical installations

UAN:	R/507/3800
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop their knowledge and understanding of the requirements and considerations surrounding electrical installations under the British standard regulation BS 7671. Understanding and following the regulation, as well being a legal requirement, ensures safety and professionalism within the building services industry.

The unit covers the fundamental principles of the BS7671 regulation itself as well as how it impacts on the selection and erection of equipment for electrical installations and the inspection and testing of systems.

Learners should consider the following questions as a starting point to this unit:

- What does the regulation BS 7671 cover?
- How does BS 7671 affect the erection of wiring systems?
- What impact does BS 7671 have on inspection and testing of electrical installations?

Learning outcomes

In this unit, learners will:

1. know the fundamental principles and general assessments of BS 7671
2. know the protective measures given in BS 7671
3. know the requirements for selection and erection of BS 7671
4. know the requirements for inspection and testing in BS 7671
5. know the requirements for special locations and information within appendices of BS 7671

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome 1: Know the fundamental principles and general assessments of BS 7671

- **Topic 1.1:** Scope of BS 7671
- **Topic 1.2:** Fundamental principles
- **Topic 1.3:** Definitions
- **Topic 1.4:** Requirements for assessment

Topic 1.1

Learners will describe the scope and objective of the BS 7671 requirements for electrical installations.

Topic 1.2

Learners will explain the fundamental principles of the BS 7671 requirements for electrical installations.

Topic 1.3

Learners will explain and interpret the definitions used in BS 7671 and relate the definitions to the regulations and relevant appendices.

Topic 1.4

Learners will interpret the requirements for assessing the general characteristics of electrical installations within the scope of BS 7671.

Learning outcome 2: Know the protective measures given in BS 7671

- **Topic 2.1:** Protection for safety

Topic 2.1

Learners will identify the requirements of protection for safety within the scope of BS 7671 and interpret how requirements for safety apply 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.

Learning outcome 3: Know the requirements for selection and erection of BS 7671

- **Topic 3.1:** Requirements for selecting and erecting equipment

Topic 3.1

Learners will identify the requirements for selecting and erecting equipment, within the scope of BS 7671 and interpret how they apply to electrical installations within the scope of BS 7671 to include:

- common rules

- selection and erection of wiring systems
- protection, isolation, switching, control and
- monitoring
- earthing arrangements and protective conductors
- other equipment
- safety services**.**

Learning outcome 4: Know the requirements for inspection and testing in BS 7671

- **Topic 4.1:** Requirements for inspection and testing

Topic 4.1
Learners will identify the requirements in BS 7671 for inspection and testing and interpret how this applies to electrical installation.

Learning outcome 5: Know the requirements for special locations and information within appendices of BS 7671

- **Topic 5.1:** Special installations and locations
- **Topic 5.2:** Appendices of BS 7671

Topic 5.1
Learners will identify the requirements in BS 7671 for special installations and locations and interpret how these effect the general requirements of the regulations.

Topic 5.2
Learners will identify the information in the appendices of BS 7671 and specify how it is used to support electrical installation activities.

Guidance for delivery

It is important that the learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of situations covering working safely with different types of equipment and in different working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

Appendix 1 Sources of general information

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

City & Guilds Centre Manual

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

Our Quality Assurance Requirements

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on
Walled Garden: how to register and certificate candidates on line
Events: dates and information on the latest Centre events
Online assessment: how to register for e-assessments.

Useful contacts

UK learners General qualification information	**E: learnersupport@cityandguilds.com**
International learners General qualification information	**E: intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	**E: centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	**E: singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	**E: intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	**E: walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	**E: business@cityandguilds.com**

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: **feedbackandcomplaints@cityandguilds.com**

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and candidates studying for City & Guilds qualifications may photocopy this document free of charge and/or include a PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching candidates working towards a City & Guilds qualification, or for internal administration purposes
- candidates may copy the material only for their own use when working towards a City & Guilds qualification

The Standard Copying Conditions (see the City & Guilds website) also apply.

City & Guilds
1 Giltspur Street
London EC1A 9DD
www.cityandguilds.com