

City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32)

Version 1.6 (September 2024)

Qualification Handbook



Qualification at a glance

Subject area	Building Services Industry
City & Guilds number	2921
Age group approved	18+
Entry requirements	Please see the guidance on page 10
Assessment	2921-32 Short-answer and scenario-based questions Project
Grading	Pass / Fail
Approvals	Please see page 8 for full details
Support materials	Qualification handbook Assessment packs
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Regulatory reference number	GLH	TQT
City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations	2921-32	610/1497/7	24	28

Version and date	Change detail	Section
1.0 September 2022	Initial version	All
1.1 October 2022	Suite title removed Approval process and Assessor information clarification	Front cover 2. Centre requirements
1.2 October 2022	Learner entry requirements for Scotland added	2. Centre requirements
1.3 February 2023	Access arrangements and reasonable adjustments information amplified	2. Centre requirements
1.4 September 2023	Content updated to new Code of Practice 5 th Edition	All
1.5 October 2023	Learner entry requirements clarification Assessor requirements clarification	2. Centre requirements
1.6 September 2024	Addition of TESP (The Electrotechnical Skills Partnership) Electrician Plus logo.	Front cover

Contents

Qualification at a glance	2
Contents	4
1 Introduction	5
Structure	6
Total Qualification Time	7
2 Centre requirements	8
Approval	8
Resource requirements	8
Quality assurance	9
Learner entry requirements	10
Age restrictions	10
Access arrangements and reasonable adjustments	10
3 Delivering the qualification	12
Initial assessment and induction	12
Support materials	12
4 Assessment	13
City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32)	13
Assessment strategy	13
Time constraints	13
Test specifications	14
5 Unit	16
Structure of the unit	16
Guidance for delivery of the units	16
Unit 302/304 Design and quality assurance of largescale electric vehicle charging installations	17
Appendix 1 Sources of general information	30

1 Introduction

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

Area	Description
What is the purpose of this qualification	<p>This qualification is intended as a short course aimed at continual professional development supporting the development of knowledge/understanding of electric vehicle charging design and installations. The qualification is built to reflect the specific requirements in relation to:</p> <ul style="list-style-type: none">• The design and quality assurance of largescale electric vehicle charging installations <p>Learners undertaking this course may already be doing the associated roles from a practicing operative capacity, with proven and demonstrable skills in working as skilled and competent electricians and/or electrical installers. Validation of these skills and level of competence are reflected in the entry requirements for this qualification.</p>
Who is this qualification for?	<p>This qualification is aimed at practicing electricians interested in understanding how to design and install the range of electric vehicle charging equipment and systems available. They aim to provide expert guidance to learners wishing to gain further knowledge and understanding of electric vehicle charging equipment design and installation.</p>
What does this qualification cover?	<p>City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32): This qualification covers how to redesign commercial premises and public spaces to accommodate electric vehicle chargers and the electrical supply systems. It also covers the safety requirements, maintenance strategy and technical assurance process for designing electric vehicle charging sites.</p>
Who did we develop the qualification with?	<p>BP, Shell, Connected Kerb as well as the wider Electrotechnical sector institutions.</p>
Is it part of an apprenticeship framework or initiative?	<p>No.</p>

Structure

To achieve the **City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32)**, learners must achieve the following mandatory unit:

City & Guilds unit number	Unit title	GLH
302/304	Design and quality assurance of largescale electric vehicle charging installations	24

Total Qualification Time

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

TQT is comprised of the following two elements:

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

Title and level	GLH	TQT
City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations	24	28

2 Centre requirements

Approval

Full approval

To offer the City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32), new centres will need to gain both centre and qualification approval. Please refer to the document Quality Assurance Standards: Centre Approval Process for further information. Centres wishing to gain approval to deliver this qualification must fill out an [expression of interest](#) on the 2921 qualification page.

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

Resource requirements

Centre staffing

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

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

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

Tutors must:

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

Assessors must:

- hold an up-to-date qualification* in EVC
- have successfully completed the Smart Screen EVC course, including the Train the Trainer video for Largescale Electric Vehicle Charging Installations
- be occupationally competent or technically knowledgeable in the area for which they are assessing. This knowledge must be to at least the same level as the assessment
- ideally have an assessing qualification although not mandatory
- demonstrate CPD to remain current.

** Up to date qualifications are any UK regulated qualification with the purpose to supporting the development of knowledge/understanding of electric vehicle charging installation and maintenance.*

NB For assessors and delivery staff looking to update their qualifications for the purposes of CPD please contact EQA to discuss entry requirements.

Continuing professional development (CPD)

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

Quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance. For more detail on this visit the Quality Assurance Standards documents on the City & Guilds website.

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

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

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

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

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

The role of the EQA is to:

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

Learner entry requirements

This qualification is intended for practicing electricians. Learners **must** hold one of the following:

- City & Guilds Level 3 NVQ Diploma in Installing Electrotechnical Systems and Equipment (Buildings, Structures and the Environment) (2357-13/91)
- City & Guilds Level 3 NVQ Diploma in Electrotechnical Services (Electrical Maintenance) (2357-23/92)
- City & Guilds Level 3 in Electrotechnical Services Experienced Worker (2356-99)
- City & Guilds Level 3 Electrotechnical Experienced Worker Qualification (2346-03)
- City & Guilds Level 3 Electrotechnical qualification (5357)
- Equivalent historical qualifications (see EAS Table 4B/4C) [EAS Qualifications guide August 2023 \(theiet.org\)](#)

or

- ECS Gold Card (for domestic electrician) JIB Electrician or Approved Electrician Card

Other Awarding Organisation equivalences will also be acceptable.

For the City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32), other appropriate qualifications in the design of electrical systems should also be considered such as:

- HNC/D Diploma in Electrical and Electronic Engineering
- City & Guilds Level 4 Award in the Design and Verification of Electrical Installations (2396)

For learners in Scotland:

- Any of the above or
- SVQ in Electrical Installation at SCQF level 7 + Up to date BS 7671 Requirements for Electrical Installations

The qualifications above must have been achieved no more than 5 years prior to starting this qualification or there must be evidence the candidate has remained current by holding the latest version of the Wiring regulations qualification.

Age restrictions

This qualification is approved for learners aged 18 or above.

Access arrangements and reasonable adjustments

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

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

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

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>

3 Delivering the qualification

Initial assessment and induction

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

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

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

Support materials

The following resources are available for this qualification:

Description	How to access
Assessor packs	www.cityandguilds.com
Candidate pack for the project 304	www.cityandguilds.com

4 Assessment

City & Guilds Level 3 Award in the Design and Quality Assurance of Largescale Electric Vehicle Charging Installations (2921-32)

Candidates must successfully complete:

- One examination consisting of short-answer and scenario-based questions
- One project

Assessment Types			
Unit	Title	Assessment method	Where to obtain assessment materials
302	Design and quality assurance of largescale electric vehicle charging installations	Short-answer and scenario-based questions – externally set internally marked	Go to www.cityandguilds.com and navigate to the 2921 webpage. Password available on the Walled Garden.
304	Design and quality assurance of largescale electric vehicle charging installations	Project – externally set internally marked	Go to www.cityandguilds.com and navigate to the 2921 webpage. Password available on the Walled Garden.

Assessment strategy

City & Guilds has written the following assessments to use with this qualification:

- Short-answer and scenario-based questions
- Project

The knowledge requirements will be tested through the short-answer and scenario-based questions and the practical requirements will be assessed through the project.

Please note that for 2921-302, the examination should be supervised by centre staff. The same assessor who supervises the assessment session may be used for the marking of the assessment.

Please refer to the Assessment pack for further guidance on delivering the assessments for this qualification.

Time constraints

Qualification registration is valid for three years.

Test specifications

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

2921-302: Short-answer, scenario-based questions

Assessment conditions: Supervised examination. Learners must sit the assessment independently.

Permitted Materials:

BS 7671 Requirements for Electrical Installations, IET Wiring Regulations

IET Code of Practice for Electric Vehicle Charging Equipment Installation (*5th edition*)

IET Electric Vehicle Charging Installations at Filling Stations

Graded: Pass/Fail

Pass Mark: The pass mark for this examination is set at approx. 70%

Test:	Duration: 90 minutes		
Unit	Outcome	Number of questions	Percentage %
302	LO1 Understand how to redesign commercial premises and public spaces to accommodate electric vehicle chargers	3	20
	LO2 Understand the safety requirements for electric vehicle charging sites	7	46
	LO4 Understand the features of the electric vehicle charging equipment and associated accessories	2	13
	LO6 Know the maintenance strategy for electric vehicle charging systems	1	7
	LO7 Know the technical assurance process for designing electric vehicle charging sites	1	7
	LO8 Understand electrical supply systems	1	7
Total		15	100%

2921-304: Project

Assessment conditions: Controlled conditions. Learners must carry out the assessment independently.

The following Learning outcomes will be assessed by the project.

Learning outcome

304 LO3 Be able to select, specify and arrange the infrastructure associated with electric vehicle charging sites

LO5 Understand commissioning and handover procedures for electric vehicle charging sites

LO9 Be able to apply design criteria in relation to infrastructure associated with electrical vehicle charging sites

LO10 Know the different locations and positions of charging equipment in relation to charging or parking bays

Please see the assessment pack for further details.

5 Unit

Structure of the unit

The unit has the following:

- City & Guilds reference number
- Title
- Level
- Guided learning hours (GLH)
- Unit aim
- Assessment type
- Learning outcomes, which are comprised of a number of assessment criteria
- Range statements
- Supporting information

Guidance for delivery of the units

This qualification comprises of one **unit**. A unit describes what is expected of a competent person in particular aspects of his/her job.

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

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

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

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

Unit 302/304

Design and quality assurance of largescale electric vehicle charging installations

Level:	3
GLH:	24
Assessment type:	Short-answer and scenario-based questions (302) Project (304)
Unit Aim:	<p>This unit is aimed at practicing electricians wishing to upskill their currency of qualifications to design and quality assurance of largescale electric vehicle charging installations.</p> <p>Learners will gain a knowledge and understanding of how to redesign commercial premises and public spaces to accommodate electric vehicle chargers and the electrical supply systems. They will explore the safety requirements, maintenance strategy and technical assurance process for designing electric vehicle charging sites.</p> <p>Learners will be able to apply design criteria in relation to infrastructure associated with electrical vehicle charging and select, specify and arrange the infrastructure associated with electric vehicle charging sites. They will explore the different locations, and positions of charging equipment in relation to design and types of charging or parking bays and commissioning and handover procedures for electric vehicle charging sites.</p>

Learning outcome

The learner will:

- LO1 understand how to redesign commercial premises and public spaces to accommodate electric vehicle chargers

Assessment criteria

The learner can:

- AC1.1 describe the **considerations** for different **locations** for electric vehicle supply equipment (EVSE) installations
- AC1.2 identify the **types of equipment** used in largescale electric vehicle supply equipment installations

Range

AC1.1 Considerations

- Intended user
 - Accessibility
 - Mechanical protection
 - Billing
 - Control and integration
- Installation, testing and maintenance
 - Consideration of environment
 - Fit for purpose for location
 - Availability for maintenance
 - CDM (Construction (Design and Management)) risk assessment

AC1.1 Locations

- Petrol filling stations and similar locations
- Car parks
 - public
 - private
- Commercial and public service vehicle depots
- On-street charging

AC1.2 Types of equipment

- Single-phase
- Three-phase
- DC charging
 - Connector
 - Pantograph
- Wireless power transfer (taxi ranks, bus stops)
- Distribution pillar(s)

Learning outcome

The learner will:

LO2 understand the safety requirements for electric vehicle charging sites

Assessment criteria

The learner can:

AC2.1 apply suitable **hazard identification** and **risk management techniques**

AC2.2 identify the specific **risks associated with electricity** and how they occur

AC2.3 identify the specific **external influences** associated with EVSE installations

AC2.4 identify **risks associated with specific earthing arrangements**

AC2.5 describe suitable **methods of protecting** against the risk associated with PEN/CNE conductor faults including the implications of each method

AC2.6 identify **suitable means** for **safe isolation/emergency switching**

Range

AC2.1 Hazard identification/risk management techniques

- Bow tie approach of managing threat and consequence
- Risk matrix approach
- HSE five-step risk assessment
- Case studies/trends
- ALARP (as low as reasonably practicable)
- SFAIRP (so far as is reasonably practicable)
- CIRIA (construction industry, research and information association) and CDM (Construction (Design and Management)) documents

AC2.2 Risks associated with electricity

- Electric shock
- Fire and DC arcing
- Explosion
- Earth fault
- Short circuit
- Overloads
- High voltage and low voltage
- Manufacturer's instructions with regard to battery ventilation requirements
- Requirements for hazardous zones in petrol filling stations
- Sealing against vapor migration in fuel filling stations

AC2.3 External influences

- Manufacturer's instructions with regard to battery ventilation requirements
- Requirements for hazardous zones in petrol filling stations
- Sealing against vapor migration in fuel filling stations

AC2.4 Risks associated with specific earthing arrangements

- TN systems from public supply
- TN-S dedicated supply
- TT (whole installation)
- IT (where used for mode 4 charging arrangements)

AC2.5 Methods of protecting against

- Use of earth electrodes
- Voltage measuring devices (Open PEN conductor detection devices)

- Assessment of simultaneous contact between extraneous- and exposed-conductive-parts connected to different earthing systems
- Protection in IT systems (Regulation group 411.6 and Section 2.2 of the APEA/IET publication Electric Vehicle Charging Installations at Filling Stations)

AC2.6 Suitable means

- Consideration of complex isolations
- Consideration of parallel sources of supply
- Limitation of access to substations and switchgear

AC2.6 Safe isolation/emergency switching

- Electrical systems
- Sites with multiple supplies (AC and/or DC)
- Fuel systems (Section 4.2 of the Filling Station Supplement)
- Gas systems (Section 4.2 of the Filling Station Supplement)

Learning outcome

The learner will:

LO3 be able to select, specify and arrange the infrastructure associated with electric vehicle charging sites

Assessment criteria

The learner can:

AC3.1 select, specify and arrange **suitable equipment**

AC3.2 identify **specialist components** of high current EVSE

AC3.3 select the types and applications of **protective devices**

AC3.4 select appropriate **means of isolation**

AC3.5 describe appropriate **means of switching**

Range

AC3.1 Suitable equipment

- Distribution
- Energy storage
- Cable management
- Cable types
- External influences
- Civil works

AC3.2 Specialist components

- High power DC chargers (HPDC), eg Power modules, inverters, cables and connectors, high-power liquid-cooled EV charging cable, metering, DC metering communications, protective devices (AC and DC) IMD, RCM
- Rectifiers / AC to DC Chargers
- Inverters
- Infrastructure monitoring systems through the internet of things (IOT)

AC3.3 Protective devices

- Overcurrent protection
- Residual current devices (RCDs) including types
- Arc fault detection devices
- Surge protection
- IMDs and RCMs

AC3.4 Means of isolation

- On-load isolation
- Off-load isolation

AC3.5 Means of switching

- Emergency switching off
- Functional switching
- Switching for mechanical maintenance
- Firefighter's switching

Learning outcome

The learner will:

- LO4 understand the features of the electric vehicle charging equipment and associated accessories

Assessment criteria

The learner can:

- AC4.1 identify the operational differences between different **charger modes**
AC4.2 describe different charger **ratings, features, applications and settings**

Range

AC4.1 Charger modes

- Mode 3 single-phase
- Mode 3 three-phase
- Mode 4

AC4.2 Ratings, features, applications and settings

- Multiple vehicle connectors
- Tariff metering
- kW ratings
- Charge times and ranges
- Remote charging equipment supplying vehicle charge posts
- Tethered cables
 - Selection
 - Lengths
- Control pilot
- Charge status (car to post)
- Control and shutdown systems
- Vehicle connector types
- Charger connectivity methods
- Open PEN detection systems
- Dynamic phase balancing systems
- Dynamic load curtailment

Learning outcome

The learner will:

LO5 understand commissioning and handover procedures for electric vehicle charging sites

Assessment criteria

The learner can:

AC5.1 explain the **commissioning procedure** role of designers for new charging installations

AC5.2 describe the **requirements for handing over** the commissioned system to the client and other stakeholders

Range

AC5.1 Commissioning procedure

- Check firmware / software functions correctly
- Functional testing (can be simulated using a dedicated EVSE tester)
- Hardware functioning correctly (Switching and controls)

- Register with the manufacturer

AC5.2 Requirements for handing over

- Manufacturer's third-party certification
- Electrical installation certification to BS 7671
- Recommending the initial frequency for periodic inspection and testing
- Local Authority certification
- Operation and maintenance manuals
 - Training on use and maintenance
 - Client's own site acceptance testing procedure or quality assurance process
 - Indication and parameters if system is working normally
 - Alarms and error messages
 - Shut the system down to a safe state
 - Installation and commissioning records
- Health and safety file
 - Client health and safety briefing
- Other stakeholders
 - Operation and maintenance organisations
 - Tenants

Learning outcome

The learner will:

LO6 know the maintenance strategy for electric vehicle charging systems

Assessment criteria

The learner can:

AC6.1 explain the types of **maintenance required**

AC6.2 describe the **factors** affecting unit downtime

Range

AC6.1 Maintenance required

- Planned preventative
- Reactive maintenance
- Case studies
- Remote software
- Remote monitoring
- Internet of things

AC6.2 Factors

- Human factors

- Demand and grid capabilities
- Wear and tear
- Repair or replace decisions
- Manufacturers' product road maps

Learning outcome

The learner will:

LO7 know the technical assurance process for designing electric vehicle charging sites

Assessment criteria

The learner can:

AC7.1 identify the **stakeholders** involved in the supply chain and their responsibilities

AC7.2 explain how to check **levels of competence**

AC7.3 identify the **statutory and non-statutory** regulatory requirements and standards for electric vehicle charging installations

Range

AC7.1 Stakeholders

- Site operator (client)
- Design and project management enterprise
- Equipment manufacturers
- Equipment suppliers
- Installation enterprise
- DNO/DSO interface and the role of an IDNO
- Charge-point operator (CPO) data/software administration enterprise
- Mobility service provider (MSP)
- Remote maintenance management enterprise
- Physical maintenance enterprise
- Manufacturer's accreditation

AC7.2 Levels of competence

- Qualifications
- Experience
- Skilled persons (electrically)
- Instructed persons (electrically)
- Manufacturer's accreditation schemes

AC7.3 Statutory and non-statutory

- Electricity at Work Regulations (EAWR)
- Electricity Safety, Quality and Continuity regulations (ESQCR)
- Construction (Design and Management) Regulations (CDM)
- BS 7671 Requirements for Electrical Installations
- IET Code of Practice for EV Charging Equipment Installation *5th edition*
- Blue book (Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations)
- Petroleum (consolidation) Regulations
- The Dangerous Substances and Explosive Atmospheres Regulations

Learning outcome

The learner will:

LO8 understand electrical supply systems

Assessment criteria

The learner can:

AC8.1 identify the different **electrical energy networks**

AC8.2 explain the operating principles and requirements for **step down sub-station transformers**

AC8.3 identify the **specific considerations** for **different earthing arrangements** as applicable to electric vehicle charging installations

AC8.4 explain how **renewable sources** are integrated into electrical supply systems and installations

AC8.5 explain how to assess the **suitability of supplies**

Range

AC8.1 Electrical energy networks

- Transmission
- Distribution
- High voltage
- Low voltage

AC8.2 Step down sub-station transformers

- Delta-star configuration
- Transformer ratings
- Liquid-filled transformers
- Packaged substations

- Civil works requirements

AC8.3 Specific considerations

- BS 7671 Section 722 requirements where PME conditions apply
- Petrol filling station environments
- LV supplies from more than one substation transformer
- Combined and separated HV and LV earthing (hot site)
- HV (BS EN 61936-1 and BS EN 50522)

AC8.3 Different earthing arrangements

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

AC8.4 Renewable sources

- Types of renewable energy sources
- Energy storage systems
- Prosumer's arrangements
- Connected and island modes

AC8.5 Suitability of supplies

- Existing supplies
- Applications for new supplies
- Maximum demand
- Diversity
- Load analysis of existing supplies
- Load management/shedding systems
- Metering systems and tariffs

Learning outcome

The learner will:

LO9 be able to apply design criteria in relation to infrastructure associated with electrical vehicle charging sites

Assessment criteria

The learner can:

AC9.1 identify the methods used for **protection** against electric shock

AC9.2 demonstrate procedures for designing **circuits**

Range

AC9.1 Protection

- Basic protection
- Fault protection methods
- Earthing
- Bonding

AC9.2 Circuits

- Distribution circuits
- Final circuits
- Current carrying capacity
- Voltage drop
- Earth fault loop impedance
- Thermal constraints
- Prospective fault current handling

Learning outcome

The learner will:

LO10 know the different locations and positions of charging equipment in relation to charging or parking bays

Assessment criteria

The learner can:

AC10.1 determine the optimum position of charging points in relation to **charging bays**

AC10.2 explain the factors affecting **site layout**

Range

AC10.1 Charging bays

- End-bay 90 degree
- End-bay angled
- Mid-bay
- Drive through starter gate
- Charger inlet positions on vehicle
- Charger cable lengths
- Drive through traditional petrol station layout

- Pantograph

AC10.2 **Site layout**

- Visibility
- Pedestrian routes
- Accessibility and disabled parking bays
- Avoidance of trip hazards
- Avoidance of any unnecessary obstructions
- Segregation of vehicle types (HGV, combustion engine vehicles etc.)
- Vehicle flow
- Shop or service station location
- Location of controls
- Protection against vehicle impact
- Signage and branding
- Infrastructure
- Underground service infrastructure
- Overground service infrastructure
- Ventilation and cooling
- Proximity to hazardous zones
- Publicly accessible commercial
- Private commercial

Unit 302/304 Design and quality assurance of largescale electric vehicle charging installations

Supporting Information

Unit guidance

Scope of course and limitations: learners on this course may need to undertake further CPD in associated topics not covered by this course

Suggested learning resources

Key guidance publications for this unit include:

- IET Code of Practice for Electric Vehicle Charging Equipment Installation *5th Edition*.
- APEA/EI Guidance for Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations (often referred to in the industry as the 'Blue book').
- IET/APEA Electric Vehicle Charging Installations at Filling Stations
- IET Guidance Note 3 Inspection and Testing
- IET Electrical Installation Design Guide (5th Edition)
Note: cables often used for the application are steel-wire armoured (SWA) type, and, because the cross-sectional area (csa) of the armour of BS 5467 cables exceeds 16 mm² for all SWA cables of csa 1.5 mm² or greater (with the exception of 2- and 3-core 1.5 mm²), consideration of the reactance of the earth fault loop in line with PD IEC/TR 50480 is recommended. See Appendix D or Appendix M, Section D5-3, of the 5th Edition 2023.
- BS 7430 Code of practice for protective earthing of electrical installations
- CIRIA guidance C755 CDM 2015 - construction work sector guidance for designers
CIRIA guidance C756 CDM 2015 - workplace 'in-use' guidance for designers

Further standards (as referenced from BS 7671) for controls and telecommunications cabling installation are:

- BS 6701 Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance. Specification for installation, operation and maintenance
- BS EN 50174-2 Information technology. Cabling installation. Installation planning and practices inside buildings
- BS EN 50174-3 Cabling installation. Installation planning and practices outside buildings

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

Quality Assurance Standards: Centre Handbook

This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on

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

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

Quality Assurance Standards: Centre Assessment

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

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

Access arrangements - When and how applications need to be made to City & Guilds

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

The **Centre Document Library** also contains useful information on such things as:

- Conducting examinations
- Registering learners
- Appeals and malpractice

Useful contacts

Please visit the Contact Us section of the City & Guilds website, [**Contact us**](#)

City & Guilds

For over 140 years we have worked with people, organisations and economies to help them identify and develop the skills they need to thrive. We understand the life changing link between skills development, social mobility, prosperity and success. Everything we do is focused on developing and delivering high-quality training, qualifications, assessments and credentials that lead to jobs and meet the changing needs of industry.

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

The City & Guilds community of brands includes Gen2, ILM, Intertrain, Kineo and The Oxford Group.

Copyright

The content of this document is, unless otherwise indicated, © The City & Guilds of London Institute and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and learners 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 learners working towards a City & Guilds qualification, or for internal administration purposes
- learners 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.

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

City & Guilds of London Institute
Giltspur House
5-6 Giltspur Street
London
EC1A 9DE

[**cityandguildsgroup.com**](http://cityandguildsgroup.com)