

COMMERCIAL & INDUSTRIAL EV CHARGING

Technical Guide | Electrical Infrastructure, Charging Power & System Design

A practical technical overview for workplace, fleet and commercial EV charging projects - from site capacity and charger selection through to distribution, protection, load management and commissioning.

01 | TYPICAL EV CHARGING ARRANGEMENT

DNO / Transformer → Main LV Switchboard → MCCB / EV Submain → EV Distribution Board → Charger Circuits → EV Charge Points

For larger sites, CT metering and a load-management controller may monitor the main incomer or selected building loads and dynamically control the available charging capacity.

02 | CHARGER POWER & APPLICATION

TYPE	TYPICAL OUTPUT	COMMON COMMERCIAL USE
AC single phase	7 kW	Workplaces, staff parking, longer dwell times and overnight fleet charging.
AC three phase	11-22 kW	Fleet, destination and workplace charging where vehicles and site supply support three-phase AC charging.
DC charging	>22 kW	Higher-utilisation fleets and locations where shorter charging times are required; electrical demand and infrastructure requirements increase significantly.

The charger rating is not the same as the charging rate every vehicle will achieve. Vehicle onboard-charger limits, battery state, temperature and charging strategy can all affect actual power transfer.

03 | SITE CAPACITY & MAXIMUM DEMAND

The starting point for a commercial EV project is the existing site load. Adding multiple chargers at full connected load can create a substantial new demand, so the design should establish the available capacity before deciding how many chargers can operate simultaneously.

Typical information includes:

- Supply size and DNO connection details
- Existing maximum demand / half-hourly or logged load data
- Transformer and main LV switchboard ratings
- Existing MCCB, busbar and submain capacity
- Planned building loads or machinery additions
- Number of vehicles, battery sizes and daily mileage
- Arrival/departure times and available dwell time
- Required future charger numbers

04 | DIVERSITY & LOAD MANAGEMENT

EV charging diversity should be based on the operational charging strategy rather than an arbitrary assumption. A dynamic load-management system can measure site demand and vary charger output so that EV charging uses available headroom without exceeding a defined site limit.

For fleet sites, charging priority can also be based on departure time, vehicle state of charge, user group or charger allocation, depending on the selected platform.

05 | DNO / SUPPLY CONSIDERATIONS

Where the proposed demand cannot be accommodated by the existing supply, early engagement with the Distribution Network Operator may be required. Larger workplace and depot schemes should consider DNO requirements, available network capacity and whether a new or upgraded connection is needed.

06 | EV DISTRIBUTION EQUIPMENT

Multi-charger projects commonly use a dedicated EV section board or distribution board supplied from the main LV switchboard. The arrangement may include an MCCB incomer, outgoing protective devices, surge protection, metering, CTs and communication equipment.

Key design parameters include board rated current, prospective fault current, short-circuit capability, spare ways, cable entry, enclosure/IP rating, metering requirements and future expansion.

07 | CIRCUIT & SUBMAIN CABLE DESIGN

EV circuits can operate at high load for extended periods. Cable selection should therefore consider design current, installation method, ambient temperature, grouping, voltage drop, fault protection and route length.

For larger schemes, parallel SWA or single-core cable arrangements may be required for the EV submain. Long external runs can make voltage drop and cable cost significant design factors.

08 | RCD & DC RESIDUAL CURRENT PROTECTION

The protective arrangement should be based on the specific charger. EV charging points require appropriate RCD protection and consideration of DC residual currents. Some chargers incorporate the necessary DC detection and/or RCD functions, but the exact manufacturer specification must be verified before selecting upstream protection.

Unnecessary duplication of residual-current devices can create coordination and nuisance-tripping issues, so the complete protective arrangement should be considered as a system.

09 | PME / OPEN-PEN PROTECTION & EARTHING

Where PME/TN-C-S earthing is present, the EV charging design must address the risk associated with an open PEN conductor. Modern commercial chargers may incorporate open-PEN protection, but suitability depends on the equipment and supply arrangement.

The designer should also consider simultaneous contact with other conductive parts or different earthing systems, particularly in car parks, street furniture and mixed-use external areas.

10 | SURGE PROTECTION

SPD requirements should be assessed for the complete installation. Where a dedicated EV board is remote from the main switchboard, the distribution arrangement, cable length, existing SPDs and charger manufacturer's requirements should all be reviewed.

11 | CT METERING & ENERGY MONITORING

CTs can be used for dynamic load management, sub-metering and energy monitoring. Depending on the system, CTs may monitor the site incomer, EV submain or individual chargers.

Useful monitoring data can include total EV consumption, charger utilisation, peak demand, charging times and the proportion of energy supplied from on-site generation.

12 | SOLAR PV INTEGRATION

EV charging can be coordinated with commercial solar PV. Where vehicles are connected during solar-generation periods, load-management or energy-management controls can increase charging when surplus generation is available.

The achievable benefit depends on the site's generation profile, building demand, vehicle dwell times and charging priorities. Solar generation should therefore be assessed against real site and fleet usage rather than simply against total annual EV consumption.

13 | BATTERY STORAGE

Battery storage can potentially support peak-demand management or shift energy between generation and charging periods, but it should be assessed against the actual load profile, tariff structure, required charging power, cycling strategy and commercial return.

14 | PHYSICAL INSTALLATION

The electrical design needs to work with the car-park layout. Charger position, cable reach, trenching, ducting, feeder pillars, containment, plinths, bollards and vehicle routes can materially affect the project.

Outdoor equipment should have an appropriate enclosure/IP rating and mechanical protection. Cable routes should avoid creating trip hazards and allow practical maintenance access.

15 | COMMUNICATIONS & BACK-OFFICE SYSTEMS

Many commercial chargers rely on Ethernet, Wi-Fi or cellular communications for user access, reporting, tariffs, remote diagnostics and load management. Network coverage and communication infrastructure should therefore be considered during the site survey rather than after installation.

16 | TESTING & COMMISSIONING

The fixed installation and charger functions should be verified before handover. Depending on the system, testing may include:

- Continuity, insulation resistance and polarity
- Earth fault loop impedance and prospective fault current
- RCD operation where applicable
- Phase sequence for three-phase equipment
- Protective-device ratings and settings
- Charger functional test and vehicle/EVSE simulation where appropriate
- Open-PEN protection verification where applicable
- Load-management CT direction, scaling and response
- Metering and communications
- Emergency isolation / controls where provided

17 | INFORMATION REQUIRED FOR DESIGN

- Site single-line diagram and supply details
- Maximum-demand or half-hourly consumption data
- Main LV board / transformer ratings and fault information
- Proposed charger quantities, locations and power ratings
- Vehicle types, daily mileage and dwell times
- Cable route lengths and installation methods
- Parking layout, civils and physical-protection requirements
- Communications / back-office requirements
- Solar PV, battery or energy-management integration
- Future fleet and expansion plans

THE QUEST APPROACH

One Contractor. One Electrical Solution.

QUEST Electrical can assess the existing LV infrastructure and deliver the complete EV charging electrical package, including distribution boards, MCCBs, submains, containment, load management, metering, charger supplies, testing and commissioning. Where required, the EV project can also be considered alongside commercial solar PV and wider electrical infrastructure upgrades.

QUEST ELECTRICAL | Workplace EV Charging | Fleet Charging | Load Management | LV Distribution | Solar PV | Testing & Commissioning

Technical note: Charger output, cable sizes, protective devices, fault ratings, RCD/PEN arrangements and load-management settings are project-specific. Final design should be based on site data, calculations, current standards and the selected equipment manufacturer's technical information.

Reference basis checked September 2026: current BS 7671 requirements including Section 722, BS EN IEC 61851, IET EV Charging Code of Practice and current UK government commercial chargepoint guidance.