UKEVSE

UK ELECTRIC VEHICLE SUPPLY EQUIPMENT ASSOCIATION

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Making the right connections

General procurement guidance for electric vehicle charge points

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Second Edition (2019)

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1.0 Introduction and Executive Summary

1.1 Who and what is this guide for?

This is the second edition of the UK Electric Vehicle Supply Equipment Association (UK EVSE) General Procurement Guidance for Electric Vehicle Chargepoints. Consistent with the first edition, published in 2015, the aim is to provide an overview of the processes and procedures involved when procuring Chargepoints. As with the first edition, this guide covers: equipment considerations; location choice; planning; power supplies; servicing & maintenance and; revenue opportunities. This second edition includes updated content to reflect market trends, accounting for the latest generation of Chargepoint products and emerging commercial models for Chargepoint operation.

The guidance is intended for public sector organisations and private companies wishing to purchase Electric Vehicle (EV) Chargepoints to support staff, visitors and residents who have access to a plug-in EV. It is intended only as a guide and the reader is reminded that use of the information is at the reader's risk. Please note that legal advice must be sought if an agreement or contract is needed between parties in a Chargepoint project. Local Authorities must be consulted for planning and advertising consent and Traffic Regulation or Traffic Management Order (TRO/TMO) changes.

Stakeholders that may find this guide useful include:

- Businesses wishing to install Chargepoints for their vehicles or their employees' and visitors' vehicles;
- Retail, leisure, hotel and tourist sites, and associated car park operators, installing Chargepoints for customers and visitors;
- Land and property developers wishing to meet the EV charging needs of tenants, clients and customers;
- Vehicle franchise dealers wishing to install Chargepoints for their vehicles and their customers' vehicles;
- Local Authorities (including Metropolitan District; London Borough; Unitary authority; County and District councils) with an interest and varying levels of responsibility in providing Chargepoints to support local public services, employees, residents, commerce and tourism;
- Fleet operators, whether running taxis, car clubs, vans, or buses, or needing to plan for access and use of EV charging;
- Regional transport planning authorities.

1.2 Nationwide policy context

The UK EV market has grown dramatically in recent years. This growth has been promoted by a number of drivers, including:

- Manufacturers offering a wider range of plug-in vehicles;
- Local and national Government policy support for EVs, and;
- Businesses and private motorists embracing EVs as an alternative to petrol and diesel vehicles for economic, environmental and social reasons.

Recent figures from the Society of Motor Manufacturers and Traders (SMMT) show a marked increase in the adoption of EVs in the UK . The year to date figures for Battery Electric Vehicle (BEV) registrations reported in May 2019 showed a 60.2% increase from the same point in 2018. There has also been ongoing growth in availability of public access charging points. The National Chargepoint Registry (NCR) database is the official source of comprehensive information about the number, type and location of UK's public Chargepoint network. The growth of the UK Chargepoint sector has been supported by UK Government incentives and private sector investment.

1.2.1 Vehicle grants and incentives

The UK Government's Office for Low Emission Vehicles (OLEV) first introduced a package of support measures in 2010 to stimulate uptake of plug-in vehicles, including:

- Grants were made available for the purchase of plug-in vehicles including cars, vans, motorcycles and mopeds. The amounts available and eligibility criteria have been adapted on an ongoing basis. The OLEV website provides information on the latest grant values and eligibility.
- EVs have benefited from other financial incentives including:
  - Lower benefit in kind (BIK) rates for company cars;
  - Lower Vehicle Excise Duty, and;
  - Eligibility for Enhanced Capital Allowances, which permit businesses to write-off the purchase of a new EV against tax in the first year .
- The latest information on incentives for EV purchase and operation are available on government websites and through the Go Ultra Low programme – a joint initiative between the motor industry and OLEV .
- The Gov.uk website is the best source for up to date

information on benefit-in-kind and other tax rates relating to electric vehicles .

1.2.2 Charging infrastructure grants

Grants have been made available for charging infrastructure in the UK, with different schemes applying at different times and with regional variations. It is good due diligence for businesses and public bodies planning for Chargepoint installations to research the availability of grant funding, including which products are eligible and which organisations are qualified to supply and install grant funded Chargepoints. Please refer to the OLEV website for the latest information on Chargepoint grants and accredited suppliers and installers in England, Wales and Northern Ireland. The Energy Saving Trust Scotland website provides information on grants available from the Scottish Government.

1.2.3 National planning policy

The National Planning Policy Framework (2012) states that local planning authorities should support development that facilitates the use of sustainable transport modes through the provision of infrastructure. The London Plan (2016) states that in new residential developments and workplaces 20 per cent of all spaces must be for electric vehicles with an additional 20 per cent passive provision for electric vehicles in the future. Retail sites must have 10 per cent of spaces allocated to EVs . The UK Government has committed to consult on amending Building Regulations to introduce relevant requirements for new non-residential buildings with appropriate associated car parking, to future proof them for Chargepoint provision. Most Local Authority planning departments now have policies that incorporate Chargepoints. Public or private sector organisations planning a new build should contact their local planning department to discuss any obligations which may apply.

There are a number of exemptions that apply to Chargepoints under the permitted development rights set out in Statutory Instrument 2056 to make the planning process easier for installations at existing properties or locations. This means that an organisation may not need to obtain planning permission for installing Chargepoints at an exempt location. At the time of writing, the UK Government is expected to consult on a proposal to increase the height limit for the Permitted Development Right in England for the installation of EV Chargepoints in designated off-street parking spaces.

1.3 Chargepoint project implementation

Chargepoint installations have nine key aspects:

1. Chargepoint **Product**;
2. the **Power** supply available;
3. the **Placement** of the equipment;
4. the means of **Payment** for charging,
5. **Proprietorship** of the equipment;
6. **Project Management** to ensure the process runs smoothly;
7. **Price** and procurement of equipment,
8. **Installation Process**;
9. and **Publicity** to ensure the equipment is used.

1.3.1 Product

It is important to consider the type of equipment that you want to install, with a focus on the rate of charging that is most suitable. Chargepoints are available that can take over 12 hours to provide a full charge, while others can provide an 80% charge in as little as 30 minutes . For some installations there is also a choice of Alternating Current (AC) or Direct Current (DC) provision. The technologies and speeds should be selected based on site characteristics including who is expected to use the Chargepoints (for example staff, the public, or both), the power availability, opening hours and amenities at the site and whether there is an intention to earn revenue from the equipment. It is also important to consider the different connector types that are prevalent in the EV market and that will be operated by the intended Chargepoint users. More detail on this is given in section 2.

Other aspects to consider include the weather that the units will be exposed, the level of vandal and graffiti protection offered, impact on the local environment including noise and aesthetics, and ease of maintenance. For more information see section two.

1.3.2 Power

For this second edition, we have added 'Power' as a category in recognition of its importance in influencing Chargepoint placement, price and operation. When the first edition of this Guide was published, Chargepoint projects were typically for a first installation at a given site, with either one or a small number of units being installed. As a result of the wider uptake of EVs, demand for EV charging is increasing, and it is now more common for projects to involve multiple Chargepoints at a given location. This makes the available power supply a more critical consideration. As power availability is always site-specific, it is strongly recommended that organisations planning a Chargepoint installation contact their local Distribution Network Operator (DNO) to identify the power availability at each location under consideration. The Energy Networks Association, the trade association that represents DNOs, provides a postcode search tool to help identify your DNO .

DNOs are responsible for ensuring that the local electrical network has the capacity and reliability to meet demand. Increases in demand by a customer can require the DNO to carry out network upgrades. Costs are passed to the end customer and vary significantly depending on the characteristics of the network and the additional demand required. Upgrades can take six months or more and can be very costly; DNO costs are usually the most significant cost element for medium and high capacity installations. Therefore, it is vital to engage with the DNO as early as possible to agree a timescale and secure the right level of budget for your Chargepoint project.

1.3.3 Placement

Placement is the most important aspect of an installation. The Chargepoint location must be convenient for EV drivers to maximise use. Additionally, choosing the right location is important in helping keep installation costs down, due to expensive long cable runs and difference in costs of excavating different ground conditions (e.g. tarmac, soil or block paving). Typical non-domestic sites include public or private owned car parks at workplaces, retail & leisure centres and park-and-rides, as well as on-street parking bays. Placement selection is driven by the purpose of the installation and the location's characteristics. For more information refer to section four.

1.3.4 Payment

Chargepoint hosts must consider whether to charge staff and/or visitors for use of the equipment. In situations where the host decides to charge the chargepoint user for usage there are various ways of managing billing and charging. Fleets will typically have a corporate account and provide drivers with RFID access cards, so the organisation is billed in arrears for charging. Instant Access systems can be supplied with many Chargepoints and can help increase utilisation, as well as generating revenue. Billing and payment, whether in arrears or at the time of charging, are controlled by a Chargepoint Management System (CPMS), which is covered in section two. Instant Access options, tariffs and considerations are discussed in section five.

1.3.5 Proprietorship

When the first edition of this Guide was published it was established practice for hosts to buy Chargepoint hardware, along with service and maintenance support and, for public access infrastructure, to appoint a third-party Chargepoint Network Operator (CPNO). In this model, the Chargepoint host is the hardware owner. This approach is still in use, but it is now common to consider other approaches to proprietorship. There are a range of business models available, each with their own benefits and drawbacks. Generally, there is a trade-off to be made between risk and revenue; the lower the risk, the lower the potential revenue and vice versa. This guide briefly reviews five possible models: own and operate, external operator, lease ownership, concession, and private funding.

1.3.6 Project management

Effective project management is vital to ensure your Chargepoint project meets time, cost and quality criteria. A knowledgeable and contactable individual or external organisation should be made responsible for monitoring progress and organising the various stakeholders and suppliers involved. Installations of one or two Chargepoints may be managed internally without too much additional work. However, installations at multiple locations and with several site hosts are most effectively managed by a dedicated individual, or external organisation, to avoid mistakes and delays. Project management is discussed in section 7.0 EV Chargepoint Project Management.

1.3.7 Price

The cost of the Chargepoint equipment is important but should not be used alone when selecting equipment and installation service suppliers. Organisations sometimes choose the cheapest supplier with little emphasis on the quality of the equipment and aftersales service. It is very important to consider the experience of the companies tendering for your project, how they support customers during and after installation and any independent advice or third-party experience you can draw on to help you make your decision. This applies mainly to private sector organisations purchasing equipment. Public sector organisations are usually restricted to only using returned tender documentation. It is therefore crucial that public sector organisations write tender specifications carefully to ensure they appoint the best supplier and installer. See section 8.0 Price, Procurement and Maintenance for more information.

The largest cost elements are the capital costs associated with installation, including DNO costs and the hardware itself. It is very difficult to provide a typical cost estimate for installation as it will depend on site characteristics such as whether power supply upgrades are required, distance from the planned installation to a suitable power supply, the surface that the Chargepoints are to be mounted on, and what vandal, graffiti and accident protection is needed. However, as a simple rule of thumb, basic installation is likely to cost about the same as the cost of the hardware for small scale installations (single units of chargepoints), with DNO costs amounting to the same again or more for larger installations (tens of units of chargepoints) or areas on constrained areas of the local distribution network.

1.3.8 Installation process

A key part of the successful implementation of Electric Vehicle Charging Infrastructure is the installation process. Whilst this subject will be touched upon in other sections of this guide (notably Power, Placement and Price), the most important information has been gathered into a specific section. See section 9.0 Installation for further details.

1.3.9 Publicity

It is crucial to raise awareness of the availability of newly installed Chargepoints to help maximise utilisation and, if applicable, revenue. The first step is to register the installation with the National Chargepoint Registry . Next, apply to have it added to ZapMap , and any local or regional network maps. Additional options for promotion include using the Instant Access service provider's website and smartphone app, communications to their member base, and social media. Most Chargepoint host organisations will add information to their own websites. Other opportunities such as advertising or press articles in local publications can help but should be considered as supporting measures rather than the primary means of promoting availability. See 10.0 Publicity and Marketing for more information.

2.0 EV Chargepoint Products

2.1 Introduction

This section provides a brief guide to the Chargepoint infrastructure and services available to a potential host. The Chargepoint technologies and access methods – the means by which a user initiates a charge and if necessary, is billed – are described along with requirements and suitability of equipment for certain locations. More detailed installation examples (including earthing considerations) and checklists are available in the IET Code of Practice on Electric Vehicle Charging Point Equipment Installation , which has been fully updated in line with the 18th Edition of the IET Wiring Regulations. For the latest information on Chargepoint compatibility please visit the UK EVSE website . Please note that when a charging time is referenced in this section it is based upon charging a 24kWh lithium polymer traction battery. Many new EV models have larger battery packs and will require proportionately longer to fully recharge.

2.2 Types of Chargepoint

Compatibility with EVs is a key consideration when choosing a Chargepoint. Chargepoints can offer one or both of AC and DC electricity supply, ranging from 13 Amps to 335 Amps, typically delivered over one of three common connector standards.

2.2.1 Summary of charging speeds

EV charging speeds vary depending on the charging infrastructure power output, the Chargepoint connector type, the vehicle-side connector type, the EV battery chemistry, State of Charge (SOC) and energy storage capacity, and the on-board charger kW power rating (for AC charging). Table 2.0 summarises the different connections, charging speeds and site suitability.

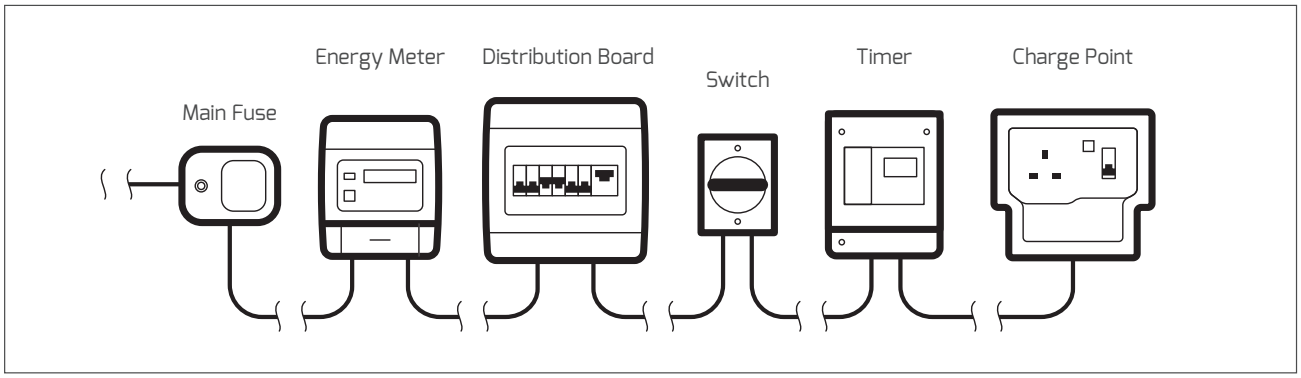
Table 2.0 – EV connection types, charging speeds and suggested site suitability

Chargepoint type and power output	Miles of range per 20 minutes of charging*	Chargepoint plug type	Vehicle plug type	Suitable locations
Slow or Standard; 2.4kW or 3kW	2.4 - 3	Standard Three Pin Plug	Five Pin 'Type 1/J1772' Plug	Domestic; Workplace (Ad hoc\Emergency use)
		Standard Three Pin Plug	Seven Pin 'Type 2' Plug	Domestic; Workplace (Ad hoc\Emergency use)
Fast; 3.7kW or 7kW	3.7 - 7	Seven Pin 'Type 2' Plug	Five Pin 'Type 1/J1772' Plug	Domestic**; Workplace; On-street; Public Car Park
Fast; 3.7 or 11kW	3.7 - 11	Tethered Lead	Five Pin 'Type 1/J1772' Plug	Domestic**; Workplace
		Tethered Lead	Seven Pin 'Type 2' Plug	
Fast; 11kW or 22kW	11 - 22	Seven Pin 'Type 2' Plug	Seven Pin 'Type 2' Plug	Domestic**; Workplace; On-street; Public Car Park
AC Rapid; 43kW	43	Tethered Lead	Seven Pin 'Type 2' Plug	Workplace; On-Street; Public Cark Park;Motorway Service Areas
DC Rapid; 20-50kW	20-50	Tethered Lead	Heavy Duty 'JEVS G105' Plug	
DC Rapid; 20-50kW	20-50	Tethered Lead	Heavy Duty 'Combo 2 CCS' Plug	
DC Ultra-rapid Charger; 120-147kW	120 - 147	Tethered Lead	Tesla Adapted 'Type 2' Plug	Charging Hub; Public Cark Park;Motorway Service Areas
DC Ultra-rapid charger; 150kW	150	Tethered Lead	CCS, CHAdeMO	Charging Hub; Public Cark Park;Motorway Service Areas
DC Ultra-rapid charger; 350kW	350	Tethered Lead	CCS	Charging Hub; Public Cark Park;Motorway Service Areas

*Range added per 20 minutes of charging calculated assuming a 3 mile/kWh vehicle efficiency.

** Up to 7kW single phase only at 32 Amps AC output from a typical household single phase AC energy supply.

Figure 2.1 - A typical slow Chargepoint installation



2.2.2 Slow charging

A 13 Amp AC three pin domestic socket (conforming to BS1363-1) on a separate circuit to other sockets (a radial circuit from the distribution board) can perform slow EV charging. The socket is usually protected by a Residual Current Circuit Breaker with Overcurrent protection (RCCBO) in addition to the circuit breakers in the existing distribution board and the main building fuse. This type of Chargepoint may be used for ad hoc charging of EVs, when visiting sites where no dedicated Chargepoint equipment is available. However, it is slow to charge (will typically charge an EV from flat to 100% in 12 hours) and is not recommended for regular use because this UK household plug and socket connection (BS1363-1) was not designed for continuous loads of 10 to 13 Amps. Charging performed using this equipment with a vehicle cable that has a pilot signal between an in-line control box in the vehicle cable and the EV is called Mode 2 charging (see Figure 2.0).

Figure 2.0 - A typical Mode 2 EV charging cable

Some business premises may have blue or red industrial Commando connectors (EN60309-1; single-phase and three-phase respectively) which can be used for Mode 1 and 2 charging of EVs or to connect mobile rapid chargers to the energy grid. They are designed to carry greater currents than a domestic BS1363-1 connection (usually 16 to 32 Amps single or three phase). The Commando connection will not be discussed further in this guide as they are not commonly used for EV charging.

A typical slow Chargepoint installation with RCCBO protection and an optional timer is illustrated in Figure 2.1. A functional switch is sometimes installed between the distribution board and the Chargepoint.

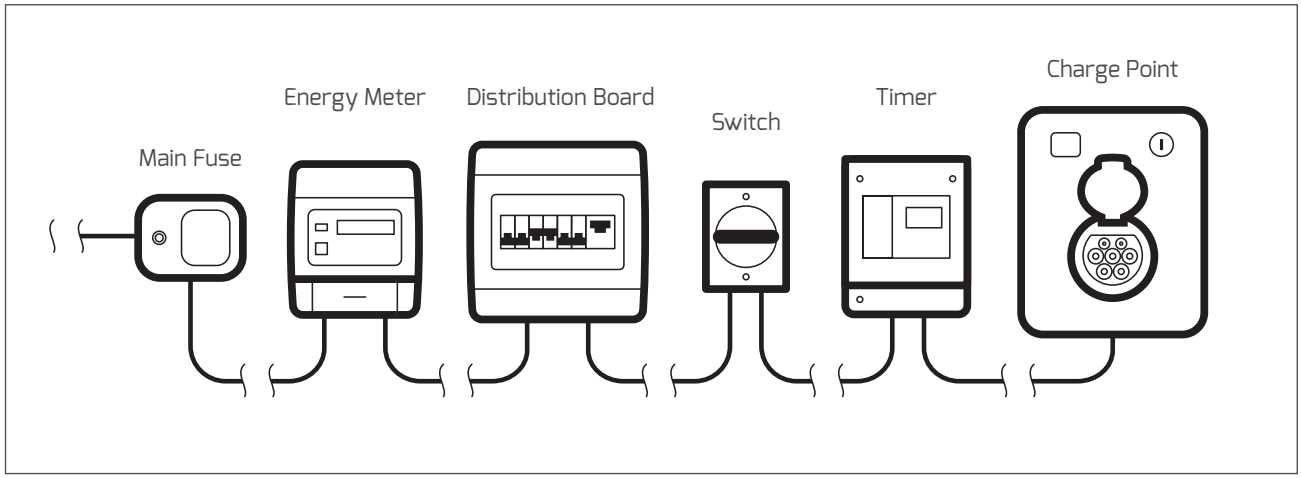
2.2.2 Fast charging

Fast charging refers to AC Chargepoints that are capable of supplying energy between 16 - 32 Amps. The speed of charge depends on the size of the battery in the EV and the performance specification of the on-board AC to DC converter. The EV communicates with the Chargepoint via a pilot signal conductor built into the charging cable. This is termed Mode 3 communication and a typical charging cable is shown in Figure 2.2.

Figure 2.2 – A typical Mode 3 EV charging cable

Mode 3 charging allows earth continuity and other safety parameters to be checked before allowing the vehicle to charge (as required by the EN61851-1 standard). A typical domestic installation with a Type 2 socket configuration and an additional timer (when this feature is not built into the vehicle or Chargepoint) is illustrated in Figure 2.3. New components are typically installed from the existing distribution board.

Figure 2.3 – A typical domestic Type 2 socket Chargepoint installation

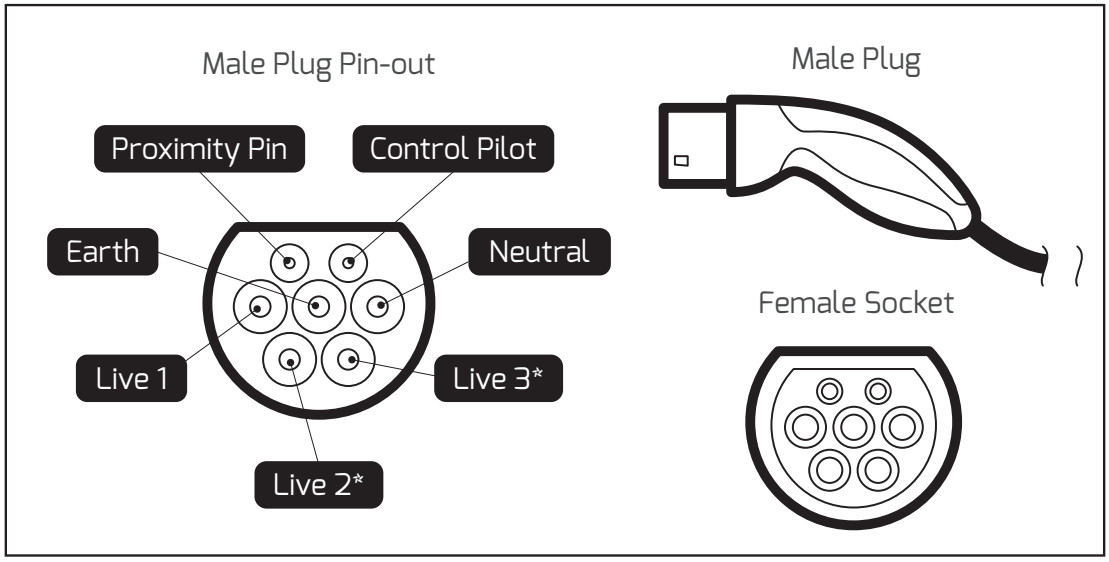


Fast Chargepoints generally use seven pin Type 2 sockets (in Europe) and are relatively small, suitable for ground or wall mounting (typically 300 mm W x 300 mm H x 200 mm D for a single Type 2 socket wall unit or 300 mm W x 1200 mm H x 300 mm D for a ground mounted unit). The Type 2 connector is an infrastructure standard (EN62196-2) adopted by the UK and the EU to serve most EVs charged by single or three phase AC energy. An example of the plug and socket is shown in Figure 2.4.

The proximity pin of a Type 2 plug disconnects the power before the plug is removed if the driver tries to unplug from a Chargepoint without a locking socket while charging is still underway. The control pilot pin is used in Mode 3 communications between the Chargepoint and the EV. Most Chargepoints lock the Type 2 plug into the socket whilst charging in order to prevent premature removal.

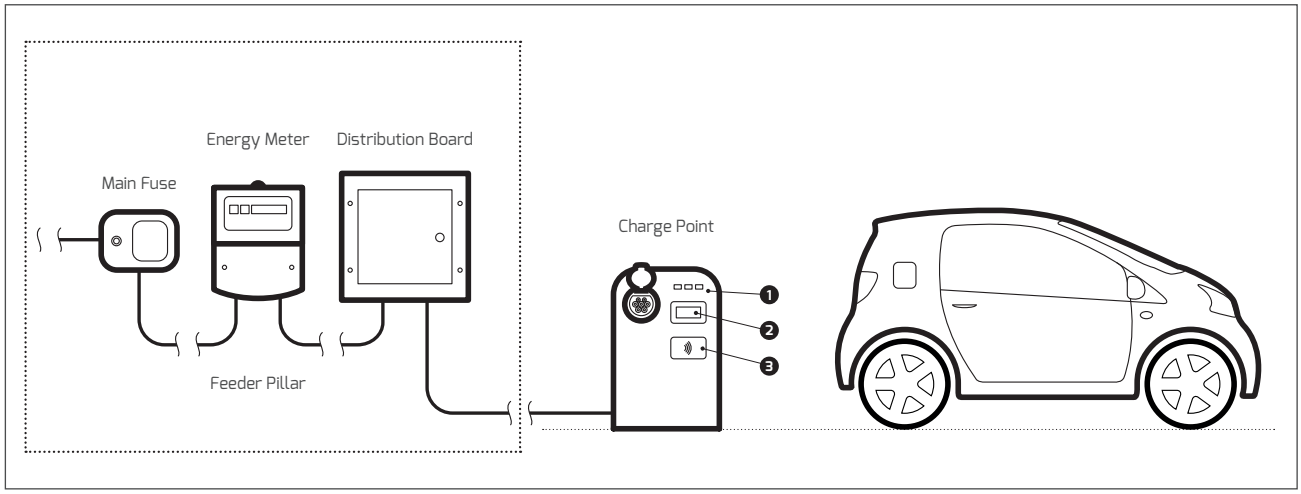
Wall mounted fast Chargepoints (like the one shown in Figure 2.3) are normally installed either at home or at a workplace where there is control over access to the location. Floor mounted fast Chargepoint variants are typically installed in car park or on-street locations as they have greater durability and do not require a wall to be mounted on. An example of a public fast Chargepoint installation is shown in Figure 2.5.

Figure 2.4 – A typical AC current Type 2 plug and Chargepoint Socket



*typically used on a three phase AC current connection only.

Figure 2.5 – A typical public Type 2 socket Chargepoint installation



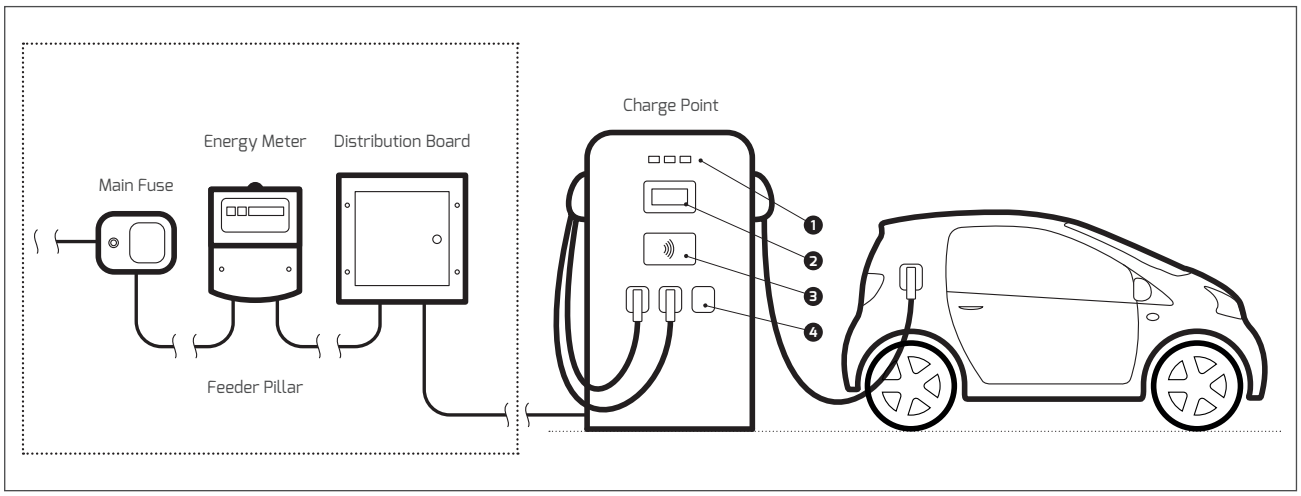
1 – LED indicator lighting; 2 - Display; 3 – RFID card reader

2.2.3 Rapid charging

Rapid Chargepoints typically provide an 80% charge in 30 to 60 minutes, depending on the vehicle's battery capacity. Units can usually supply AC or DC energy via separate tethered cables, but not always both at the same time (this is site power supply and Chargepoint model dependent).

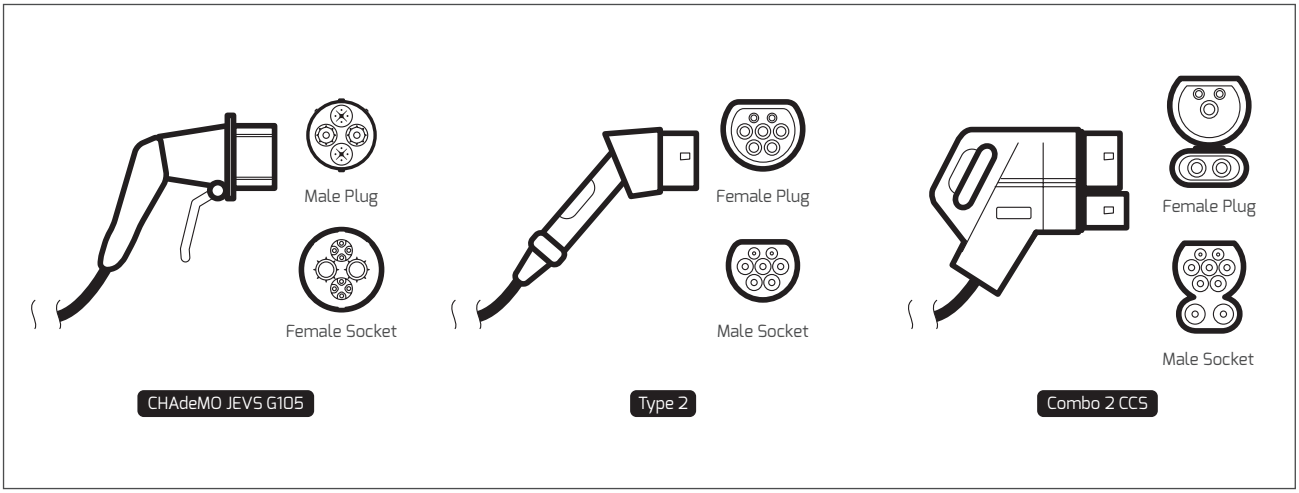
Rapid Chargepoints are usually ground mounted and resemble a conventional fuel pump. The units have similar components to fast Chargepoints, such as a Radio Frequency ID (RFID) card reader, display module and General Packet Radio Services (GPRS) modem. DC units contain an off-board charger that converts and conditions AC into DC energy suitable for charging an EV battery directly. In this case, the off-board charger communicates with the EV to determine battery parameters and ensure it is safe to charge. The AC rapid charge connection contains similar components to a fast Chargepoint, but for a higher output current and over three phases. Rapid Chargepoints have tethered plugs to connect to an EV, with three connectors in use by different vehicle manufacturers. Please see Figures 2.6 and 2.7 for further details.

Figure 2.6 – A typical rapid Chargepoint installation



1 – LED indicator lighting; 2 - Display; 3 – RFID card reader

Figure 2.7 – The three rapid charger EV connectors



Left - CHAdeMO JARI JEVS G105 DC plug and vehicle socket; middle – Type 2 plug and vehicle socket; right – Combo 2 or CCS plug and vehicle socket.

The AC rapid Chargepoint connector uses the Type 2 plug format at a higher Amp and power rating (43kW three phase output). However rapid AC charging is becoming less common with a trend towards DC for rapid charging and AC charging being used for fast charging only.

The two dedicated DC connectors are capable of providing DC energy at up to 100kW output, though rapid charging typically refers to 50kW when using DC. The Japanese JARI JEVS G105 connector is used by most CHAdeMO association compliant charging equipment (usually 125 Amps and 50 kW). The Combined Charging System (CCS or Combo 2) DC connector is similar to the Type 2 connector, but with none of the AC power pins and an additional two DC power pins incorporated into the plug below the Type 2 section. Vehicles that have a CCS socket can receive a charge from a tethered Type 2 plug Chargepoint (the first option in the rapid Chargepoint connectors listed). However, the ability of the vehicle to properly utilise the high power available via the tethered Type 2 plug on a rapid Chargepoint depends on the power rating of the vehicle's AC to DC converter, which can be found on the vehicle specification sheet.

All three rapid charging protocols communicate with the EV to ensure it is safe to charge the vehicle. Charging using the tethered Type 2 connector utilises the Mode 3 communication protocol in a similar way to fast chargers. DC charging using the JEVS G105 connector is often termed Mode 4 communication. This is where the Chargepoint communicates with the vehicle via the vehicle CANbus. Charging via CCS utilises Power Line Communications (PLC) to communicate between the Chargepoint and the EV under a separate standard to the JEVS G105 connection (ISO 15118 series).

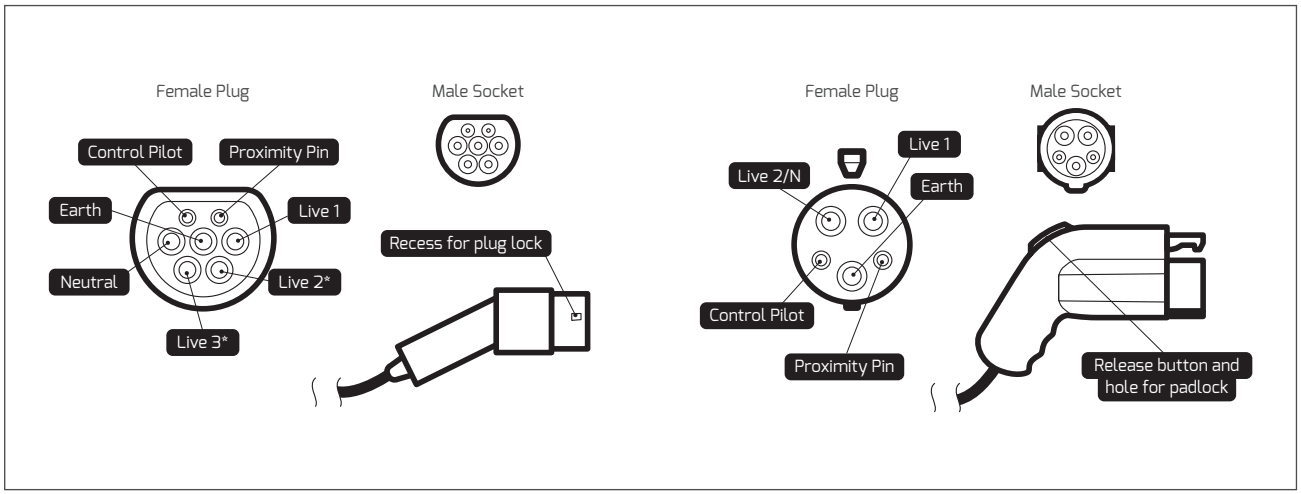
2.2.4 Ultra-rapid charging

Ultra-rapid charging refers to charging at rates above 43kW AC or 50kW DC. Charging above these rates is only provided via DC, because the weight and cost of a suitable on-board AC to DC converter would be prohibitive. The first ultra-rapid chargers in the UK were installed by Tesla for the exclusive use of their customers. Tesla use a bespoke Type 2 tethered plug that can provide DC energy at up to 145 kW, 450 Volts and 335 Amps. The tethered Type 2 plug is physically compatible with other EVs with a Type 2 vehicle socket that accepts AC energy. However, Tesla's proprietary communication software will not allow charge to be provided to other manufacturers' vehicles.

Tesla is no longer the sole provider of ultra-rapid chargers with EVSE at 150kW and above now available on the market from multiple manufacturers.

Installing ultra-rapid charging can be challenging; it would typically require a new or uprated transformer, housing for the power electronics (AC to DC converter and power conditioning) and room for the Chargepoints themselves. Installations of this nature on public or private land are likely to need planning permission and extensive work with the Distribution Network Operator (DNO) to obtain enough power capacity. However, if more EVs are produced that are compatible with faster rates of charging, it may be worth the cost and effort to provide a Ultra-rapid charger facility to attract visitors to your site.

Figure 2.8 – EV vehicle-side AC plugs and sockets



Left – Type 2 female plug and male vehicle socket; right – J1772 plug and vehicle socket
*typically used on a three phased AC current connection only.

2.2.5 Vehicle-side connectors

There are two main vehicle-side sockets used by vehicle manufacturers for fast AC charging. These are the Type 2 male socket and the J1772 or Type 1 five pin female socket. The vehicle-side Type 2 socket is an inversion of the plug and socket setup used to connect the charging cable to the Chargepoint and can transfer three phase AC where this is supplied. The J1772 socket can only accept single phase AC, limiting the rate of charge. The J1772 socket is usually found on its own on plug-in hybrid electric vehicles (PHEVs) and extended range electric vehicles (EREVs), or on some pure electric vehicles (BEVs) which accept a DC rapid charge using the JEVS G105 connector. In addition, some newer PHEVs on the market have rapid charger compatibility and use the Type 2 male socket. Please see Figure 2.8 for details of vehicle-side AC connectors.

2.2.6 Charging electric motorcycles and mopeds

There are two main approaches to charging electric motorcycles and mopeds, depending on whether or not the battery is removable.

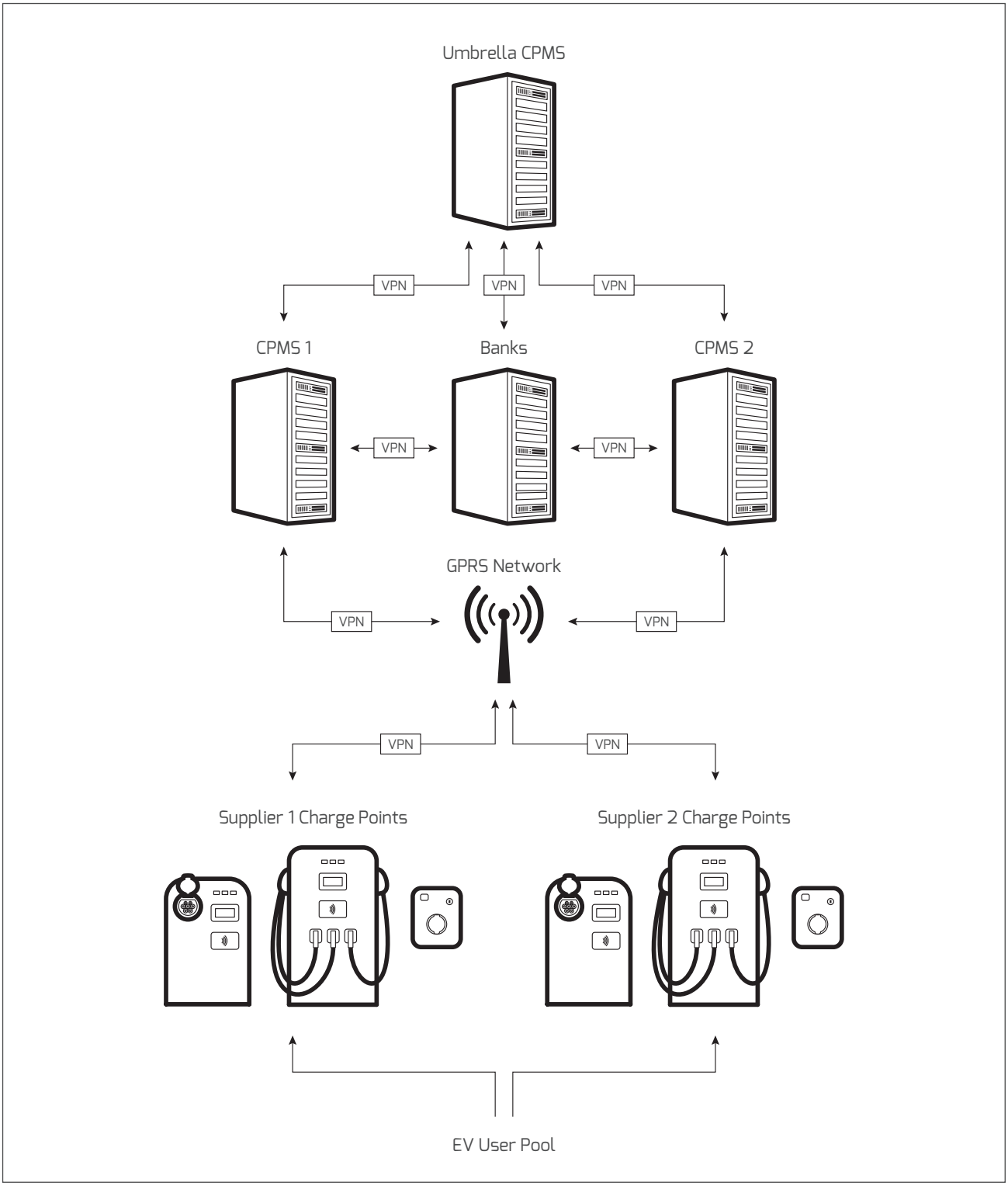
The batteries on some mopeds can be removed and then recharged from a standard domestic power socket. This is typically offered on low power two wheelers which have relatively small battery capacities. The primary benefit of this approach is that there is no requirement for specialist or dedicated Chargepoints. The batteries typically weigh around 10kg, meaning they can be carried short distances to a socket.

The charging process for non-removable batteries is similar to that for cars and vans. These vehicles are charged using an onboard socket and a dedicated Chargepoint. This allows faster rates of charging to take place, which is more suitable for larger capacity motorcycle batteries.

2.3 Chargepoint system components

Chargepoints are usually connected to a server over the GPRS mobile phone network and internet, or a hard-wired internet connection. The whole system consists of the Chargepoint equipment and its connection to the energy grid, the back-office system (Chargepoint Management System or CPMS), connection to banking networks for Instant Access functionality, and connection to an umbrella Chargepoint Management System (uCPMS). A uCPMS allows users to 'roam' independently of the Chargepoint equipment manufacturer, model, primary CPMS and geographic location. Figure 2.9 shows these system components (excluding the national grid network).

Figure 2.9 – Chargepoint system architecture



VPN – Virtual Private Network.

Figure 2.9 illustrates how a uCPMS can draw together several networks and offer a single payment clearing solution. This simplifies access and payment methods for EV drivers such that one RFID card or smartphone App can allow access to multiple networks in different regions and countries.

There is a growing range of Chargepoint equipment suppliers and back office systems in the UK. The latest back office systems on the market offer improved roaming and interoperability between different networks and Chargepoint types. This is underpinned by the adoption of the Open Chargepoint Protocol (OCPP) and the Open Smart Charging Protocol (OSCP), which are discussed in the following subsection.

2.3.1 The Chargepoint Management System (CPMS)

A Chargepoint Management System (CPMS) is a remote back office system run by CPNOs that contains a database of all Chargepoints and users of the Chargepoint network. It monitors the status of the Chargepoint equipment, activates and terminates charging events, initiates Instant Access transactions and collects network usage data.

Chargepoints are typically connected to the CPMS using a GPRS modem within the Chargepoint. This is connected via the internet to the CPMS servers by a Virtual Private Network (VPN), ideally using the 128-bit Advanced Encryption Standard (AES). In locations with poor mobile network signal, connection to the CPMS can be made by hardwiring Chargepoints to an internet router or by using a mobile network signal booster. Please consider the extra cost of the equipment required to connect Chargepoints to the internet if using the mobile network is not possible.

The way Chargepoints communicate with the CPMS depends on what command protocol the equipment supplier and CPMS uses. Since 2009, the Open Charge Alliance has promoted the benefits of the Open Chargepoint Protocol (OCPP) in order to make EV networks open and accessible. OCPP is now the de facto protocol for EV network communications.

OCPP version 1.6 is currently being deployed by CPNOs in the UK. It offers several additional features not present in version 1.5, including:

- Smart charging functionality
- Extra statuses added to the Chargepoint status enumeration, giving the CPNO and ultimately end users more information about the current status of a Chargepoint
- Chargepoint manufacturers can send information such as the state of charge of an EV to a central system

The latest version is OCPP 2.0, which was released in April 2018. New functionality includes device management, improved transaction handling and security, added Smart Charging functionalities, ISO 15118 support, and display and messaging support. At the time of writing, most EVs in the UK are only compatible with older versions of OCPP, so version 2.0 is not in general use. However, a shift to version 2.0 is expected over the coming months and years. Please refer to the OCPP website for the latest information.

The first Open Smart Charging Protocol (OSCP) was launched in May 2015 and is now ready for use. This protocol focuses on energy capacity planning for EV infrastructure, allowing up to ten times more cars to be charged on existing infrastructure. At the time of writing, work is underway to develop version 2.0 of the OSCP, and it is expected to be launched in 2019. Please refer to the OCPP website for the latest information.

2.3.2 CPMS operations and host responsibilities

The CPMS gathers data and monitors the status of connected Chargepoints. The level of intervention when problems arise generally depends on the Service Level Agreement (SLA) between the Chargepoint host and the CPNO or Chargepoint supplier. Some hosts only pay for data collection, annual maintenance checks and a reactive service when a problem is reported to the CPNO. This means that the host is responsible for checking the equipment and reporting problems to the CPNO. If this level of service is procured, UK EVSE recommends that the host undertakes regular monitoring of the equipment.

HANDY HINTS

Chargepoint hosts – Check your equipment!

For workplaces and private locations, Facilities Management should be responsible for checking Chargepoint equipment.

For Councils, the best candidates for checking that Chargepoints are working and for reporting faults are the Civil Enforcement Officers (CEOs) that issue Penalty Charge Notices (PCNs) to drivers contravening Traffic Regulation (or Management) Orders (TROs or TMOs). They must check that parking meters are functioning and so checking Chargepoints is a natural add-on to this role and should not take more than a few minutes per day. EV drivers will report faults, but this is not an ideal situation because it shows that the monitoring procedures have failed.

If the organisation paying for the equipment has applied for and used Government funding, the conditions require that the equipment is maintained, provides anonymised charging event data and that any faults are rectified quickly. If the host fails to meet these requirements, the host runs the risk of grant claw-back by the Government.

A better approach is to specify service levels such as 24/7 proactive monitoring of the equipment, remote reset and fault fixing, and automatic dispatch of engineers when remote fault fixing is not successful. These services have an associated cost but should increase Chargepoint uptime. If you have not paid for proactive equipment monitoring, you will need to check equipment yourself.

2.3.3 Status and safety components

Chargepoints contain various safety and functional components that protect and monitor equipment and help the EV driver obtain a charge. The user interface generally consists of a display screen and buttons, RFID card reader and LED status indicators to show whether the Chargepoint is "available", "charging" or "out of order". These are most commonly blue, green and red respectively. Chargepoints also contain a GPRS modem to communicate with the CPMS and an energy metering solution to monitor energy usage. Further details are provided in the Appendix.

3.0 Power

3.1 Energy supply

The energy supply is one of the most important factors in a Chargepoint installation and can be the main source of variability in the installation cost. To avoid unexpected costs, it is good practice for site surveys to be undertaken by the host or the Chargepoint installer/tendering organisation before an equipment supplier and installer is appointed. The local DNO will also be required to carry out a desktop assessment or site survey to check whether there is sufficient electrical supply to support the proposed number and rate of Chargepoints, as well as providing a quote for any upgrades required. It is also possible to use online heatmaps provided by your local DNO to obtain an approximate indication of whether capacity is likely to be available on the network prior to having the local DNO carry out an assessment. This can be helpful when identifying potential locations for the Chargepoint.

The typical components for an energy supply are a fused cut out installed by the DNO, a Meter Point Administration Number (MPAN number), an energy meter installed by the energy supplier, a suitable distribution board installed by a qualified electrician, and a mains breaker and Mechanical Circuit Breakers (MCBs) adequately rated for each connected circuit.

3.2 DNO works

DNOs are responsible for ensuring that the local electricity network has the capacity and reliability to meet demand. Increases in demand by a customer can require the DNO to carry out network upgrades. Costs are generally passed directly to the end customer and vary significantly depending on the characteristics of the network and the additional demand required. Upgrades can take six months or more and can be very costly, so it is vital to engage with the DNO as early as possible to agree a timescale and secure funding. Table 3.0 indicates the potential costs involved.

Table 3.0 – Illustrative example of DNO costs and timescales

Small	Medium	Large
(up to 70kVA)	(200kVA - 1,000kVA)	(above 1,000kVA)
Number of charge points		
1-3 Fast or 1 Rapid	10-50 Fast, 4-20 Rapid or 1-6 Ultra-Rapid	50+ Fast, 20+ Rapid or 6+ Ultra-Rapid
Approximate Connection Time		
8-12 Weeks	8-12 Weeks	6 Months +
Approximate Connection Cost		
£1,000 - £3,000	£4,500 - £75,000	£60,000 - £2 million
Other Consideration Affecting Cost		
- Street work costs	- Street work costs - Legal costs for easement and wayleaves	- Street work costs - Legal costs for easement and wayleaves - Planning Permission - Space for a Substation

There are steps you can take to reduce costs associated with the DNO:

- Investigate 'timed-profile connections', which have set times when demand must be below a certain level but permit higher demand at other times. This would minimise the DNO upgrade work required to meet demand. It should be noted that this service is not currently available from all DNOs and the terminology can vary from DNO to DNO.
- A large site may be supplied by more than one substation, so the DNO may be able to provide the capacity at a cheaper cost elsewhere on the estate.
- Consult local organisations who may also need extra capacity, with a view to spreading costs.
- Consider smart charging or vehicle-to-grid (V2G) services (see Section 3.5).
- Use load management devices and which can manage the power provided to individual compatible Chargepoints to ensure supply limit is not breached when multiple Chargepoints are in use. This can be preferable to upgrading the DNO connection, and can enable the installation and use of larger quantities of Chargepoints. Such devices are already commercially available and can be included in the specification of a procurement framework or discussed with equipment suppliers.
- In areas where network constraints are significant, consider installing a system with on-site generation (such as solar PV) and battery storage. This can be used to reduce the peak demand of the installation.

Installing a new power supply may considerably increase the time needed to complete a project. In fact, several UK DNOs state that 12 weeks is required from initial enquiry to completion of installation of the new cut out. DNOs do not install feeder pillars, distribution boards or energy meters. DNOs will only start connection works when the appropriate infrastructure (the feeder pillar) has been installed prior to their arrival.

Contact the DNO as soon as possible (before tendering for a Chargepoint supplier) to obtain low voltage grid maps and provide information on where and what you are intending to install. This is usually done via a new connections or project form provided to you, or downloadable from the DNO's website. For rapid chargers, the DNO may ask for grid harmonic disturbance information to be supplied on a standard form. This information should be available from a rapid Chargepoint supplier, and you should ask the supplier to fill in the form on your behalf. At a minimum you should know the required capacity in current and kilovolt amps (kVA) for the charger. This will allow the DNO to check the available capacity locally before you go out to tender. This checking service may incur a survey cost of about £200-£500 per site. You may not need the harmonic distortion information at this point (depending on the DNO and primary contact), but you will need to provide it after a tender appointment has been decided and before any installations can take place. Links to find and contact your DNO can be found on the Energy Networks website.

3.3 Using the Chargepoint host's energy supply

When reviewing potential Chargepoint sites, it is imperative to investigate whether there is an adequate power supply available. If there is an existing power supply with sufficient spare capacity for the planned Chargepoints then this will reduce the installation cost. A small installation of small numbers of fast Chargepoints is often achievable within the constraint of the existing power supply. However, issues tend to occur if one or more rapid Chargepoints, or a large bank of fast (7kW) Chargepoints, are required. Sites rarely have enough capacity available for larger scale installations and would require work to upgrade the local supply, or as a minimum the installation of a new, dedicated distribution board, thus increasing the cost of the installation.

Public car park and on-street locations are typically more complicated because the grid connection point may be hard to find. The host must engage with the DNO to find the most suitable connection point and request a site survey. The more information you provide on the planned installation, the more accurate the quotes will be. In addition, if more than a handful of chargepoints is being installed then it is likely that a dedicated supply point will be required. This can add tens of thousands of pounds to the cost of an installation.

Public car parks and on-street parking with pay and display grid connected parking meters may have a feeder pillar to which the parking meter is connected. Usually this energy supply will be metered and have sufficient capacity (80 Amps AC single phase) to support one fast Chargepoint at either 16 Amps or 32 Amps AC single phase per Type 2 socket. It is unlikely that a parking meter feeder pillar will support more than one Chargepoint with two 32 Amp AC single phase Type 2 sockets. Street lighting circuits are generally not metered and rarely have the capacity for Chargepoints.

As with a new energy supply, load management equipment can be used to install a greater number of chargepoints which would otherwise exceed the supply rating if all were charging at full power. Such devices limit the charging power of individual chargepoints to ensure the maximum supply rating is not exceeded.

3.4 Installing a new energy supply

Rapid Chargepoints in public places will usually require a new feeder pillar and DNO connection with meter wherever they are installed. Installation of a single unit at workplace locations with an adequate fused cut out and a distribution board with sufficient capacity may only need installation of a larger or secondary distribution board. If there is insufficient capacity at the site after being surveyed, then a new power supply will be needed. Fast Chargepoint locations that are deemed of high potential usage, but with a limited power availability will need a new supply.

In all these situations, careful consideration of the location's proximity to Low Voltage (LV) cable within the pavement, road or car park is critical. Minimising this distance and avoiding having to dig up road surfaces will reduce installation costs considerably (in the order of several thousand pounds). It is also important to identify other buried services such as telecoms, gas and water supplies.

Energy meters are installed by an energy supplier after the fused cut out has been installed and an MPAN provided by the DNO. This is a risk factor in a project and will need an individual or organisation to co-ordinate the work. It is therefore imperative that the host or a host employed electrical contractor, Chargepoint supplier or consultant, liaises with the DNO and energy supplier to make sure that everything runs smoothly. UK EVSE members have found that delays occur if the electrical contractor nominated to install the feeder pillar has not met the timescales required for DNO works to provide a connection, resulting in time delays and sometimes increased costs. Additionally, if the DNO quote expires before it is accepted, this can result in connection costs being re-quoted at higher costs that originally agreed. A similar situation can arise if the energy meter has not been installed in time for the installer to connect and commission the Chargepoints.

Table 3.1 on the next page indicates the necessary power considerations for various Chargepoint equipment. It is intended as a guide; Chargepoint hosts should consult their electrician and the local DNO before commissioning a new connection. Note that maximum current demand will vary depending on the equipment procured. In addition, connections are based on standard circuit breaker ratings, meaning that a larger connection may need to be procured than is required for the desired number of points, often resulting in significantly higher costs. Again, the application of load management can enable larger installations to remain within a lower circuit breaker rating, reducing the overall costs of the work.

Table 3.1 – Chargepoint types, charging times, and power supply requirements

Chargepoint type and power output	Miles of range per 20 minutes of charging*	Distribution board requirements per socket/ plug (outlet)	New energy supply capacity needed per Chargepoint now	New energy supply capacity per Chargepoint for future-proofing
Slow or Standard; 2.4kW or 3kW	2.4 - 3	One radial AC single phase connection; 13 Amps	Usually not needed	80 or 100Amps AC single phase (for a faster Chargepoint)
Fast; 3.7kW AC	3.7	One radial AC single phase connection; 16 Amps	32Amps AC single phase (2 outlets)	80 or 100 Amps AC single phase (for a faster Chargepoint)
Fast 7kW AC	7	One radial AC single phase connection; 32 Amps	63Amps AC single phase (2 outlets)	Three phase AC supply; 100 Amps per phase (for a faster Chargepoint)
Fast 11kW AC	11	One radial AC three phase connection; 16 Amps per phase	Three phase AC supply; 32 Amps per phase (2 outlets)	
Fast 22kW AC	22	One radial AC single phase connection; 32 Amps per phase	Three phase AC supply; 63Amps per phase (2 outlets)	
Rapid 20kW DC	20	One radial AC three phase connection; 32Amps per phase	Three phase AC supply; 32 Amps per phase (1 outlet)	Three phase AC supply; 100 Amps per phase (2 outlets)
Rapid; 43kW AC	43	One radial AC three phase connection; 63 Amps per phase	Three phase AC supply; 63 Amps per phase (1 outlet)	Three phase AC supply; 126 Amps per phase (2 outlets)
Rapid 50kW DC	50	One radial AC three phase connection; 77 Amps per phase	Three phase AC supply; 77 Amps per phase (1 outlet)	Three phase AC supply; 154 Amps per phase (2 outlets)
Ultra-rapid charger; 150kW DC	150	One radial AC three phase connection; 236 Amps per phase	Three phase AC supply; 236 Amps per phase (1 outlet)	Three phase AC supply; 472 Amps per phase (2 outlets)
Ultra-rapid charger; 175kW DC	175	One radial AC three phase connection; 263 Amps per phase	Three phase AC supply; 263 Amps per phase (1 outlet)	Three phase AC supply; 526 Amps per phase (2 outlets)
Ultra-rapid charger; 350kW DC	350	One radial AC three phase connection; 500 Amps per phase. Other configurations possible, e.g. 2x 250 Amp three phase connection for dual power cabinet configuration.	Three phase AC supply; 500 Amps per phase (1 outlet)	Three phase AC supply; 1000 Amps per phase (2 outlets)

*Range added per 20 minutes of charging calculated assuming a 3 mile/kWh vehicle efficiency.

3.5 Smart charging and Vehicle to Grid (V2G)

Smart charging is the ability for EV supply equipment to control the timing and power of charging in response to a user-defined input or signal. At the most basic level, this allows charging to be scheduled for times when grid demand is lower. Dynamic demand shifting can also be used to provide energy services including time of-use tariff optimisation, peak demand shaving, network constraint management and renewable electricity generation optimisation.

Network upgrade costs for multiple Chargepoints can run to tens of thousands of pounds, making network connection highly expensive and in some cases unviable. Smart charging capability is an embedded functionality in all modern chargepoints and is defined by OLEV in the Electric Vehicle Homecharge Scheme Minimum Technical Specification . OLEV also maintains a list of approved chargepoint models which conform to this specification . However, it should be noted that not all 'Smart' chargepoints are the same. The "smart" functionality of a Chargepoint depends on the capability of the CPMS. One particularly beneficial function, as described earlier in this document, is load management. This enables the charge rate (power) across a group of Chargepoints to be limited at times at times of high demand whilst allowing the Chargepoints to operate at full power at times of low demand. This can be done dynamically (each chargepoint operating at different charge rates to match the requirements of the users) or statically (charge rates are levelised across all chargepoints). In either case, this can mitigate the need for expensive network upgrades.

Vehicle-to-Grid (V2G) is an innovative system whereby vehicles can provide bi-directional flows of energy when connected to EV supply equipment. V2G Chargepoints can therefore both charge and discharge an EV. Discharged energy from the vehicle can be used to meet on-site demand, or to export electricity to the LV network. This allows the energy stored in an EV to be traded in electricity markets to generate income from the vehicle whilst it is not in use. Because the electricity can be dispatched when the grid needs it most, it can be sold at a profit. At the time of writing, V2G is not yet fully developed as a commercial service and has limited commercially viable applications. However, with the number of providers increasing and costs of hardware reducing, V2G is likely to become a key part of the EV Chargepoint mix over the next decade.

In early 2018, a DC V2G Chargepoint cost £15,000-£20,000. Prices have dropped over the subsequent 12 months, with prices now ranging from £3,000-£10,000. Prices are projected to continue to fall over in the next few years, bringing DC V2G closer to the cost of an AC smart chargepoint. AC V2G systems are also under development which could further reduce the cost of the Chargepoint. However, an AC V2G system would require additional power electronics to be installed in the connected EV in order for it to be compatible.

4.0 EV Chargepoint Placement

4.1 Introduction

This section introduces the different location types and features you will need to consider to maximise Chargepoint use and, if applicable, revenue generation.

4.2 Types of location

4.2.1 Workplace

Workplaces are usually an easier location at which to install chargepoints because many host organisations are already invested in the idea to supply EV charging infrastructure for its staff and visitors. However, this is not always the case. It can often be difficult for a commercial tenant/leaseholder to install Chargepoints as many landlords/freeholders do not currently appreciate this need, and the process to gain permission can be lengthy, expensive and difficult to navigate. It is also common to see delays and difficulties gaining agreement in large organisations where decisions need to be made by multiple groups of stakeholders.

Workplace sites often have sufficient spare power capacity available for one or two fast Chargepoints but may not have enough for a rapid Chargepoint or a bank of fast chargers. However, it is always advisable to arrange for a professional to carry out an assessment before procuring hardware, where appropriate including a DNO assessment. The impact of EV charging on total site load will depend on the intended user. For example, a day worker looking to charge their personal vehicle during normal office hours may impact the total site load more than a fleet vehicle which can charge overnight.

Wall mounted units with key or RFID card access are common. A workplace Chargepoint does not usually need to be as vandal or graffiti resistant as equipment in public locations and therefore wall mounted chargepoints are common in this environment. Parking is usually restricted to employees and visitors only and is often protected by a barrier. It is unlikely that these sites will be made fully accessible to the public.

4.2.2 Public car park

Public access car parks can be owned by local authorities or private businesses. Local authority-controlled car parks usually have signs with the logo of the owning local authority. Permission for Chargepoint installations must be sought from the relevant authority. Traffic Regulation Orders (TROs) are usually required for these locations, with enforcement provided by Civil Enforcement Officers (CEOs), who are authorised to issue Penalty Charge Notices (PCNs). See section 4.3 for more information on enforcement.

Privately owned and operated car parks are often found at shopping centres, retail parks and motorway service areas. Private ownership is usually identified by signage at the site with the contact for the management company. The car parks are usually either;

1) Barrier controlled with Pay on Foot parking payment machines; or
2) Automatic Number Plate Recognition (ANPR) managed; or
3) Parking company patrolled.

It is typically easier for private site operators than public sector operators to alter the terms of use of their car parks.

Access hours and entry restrictions i.e. can vary considerably between car parks. City centre and motorway service car parks are usually open 24 hours a day, whereas Park and Ride sites typically operate for a maximum of 12 hours (for example between 7am and 7pm daily except Sundays and Bank Holidays). It is crucial to consider restrictions and opening times before deciding in which car park to install Chargepoints. In car parks which regularly reach capacity, the owner may be concerned about losing revenue by designating EV-only parking bays. Likewise, they may be reluctant to move disabled access parking bays, as they will need to be reinstated elsewhere in the car park, with a cost attached to doing so. When reviewing a potential site, look for power supplies that were originally used to power parking meters. If they are not attached to lighting circuits, and are independent metered grid connections, they may be suitable for one or two fast Chargepoints.

The charging infrastructure should match the typical dwell time for vehicles at the car park. In one extreme, car parks that are used for very short stays will require rapid chargers, whereas long stay car parks can make use of larger numbers of lower power (ie. 7kW) chargers.

Security may be an issue in public car parks. It is well documented that EV drivers will avoid using Chargepoints where they feel unsafe. This is because EV drivers are required to be outside their car for longer periods to plug in/unplug from a chargepoint compared to other drivers. Therefore, in order to maximise usage, it is advisable to install Chargepoints in well-lit areas of a car park, close to busy locations and with CCTV coverage. The Chargepoint unit should have appropriate vandal and graffiti resistance for this type of location, and this should be stated in the tender specification.

4.2.3 On-street

On-street parking bays are usually owned and/or operated by local authorities, transport authorities (e.g. for example Transport for London) or the Highways Agency. Permission to install Chargepoints must be sought from the relevant authority. Parking is usually restricted and enforced to a certain length of time and may be Pay and Display or Pay by Phone. A TRO or TMO is required to enforce parking conditions and restrictions in these locations and CEOs will patrol regularly. Few on-street sites are owned by private businesses unless the parking is on an access road onto their property. Parking at these sites will generally be at a premium as the sites are usually in town and city centres. Contact the local authority's parking team to identify the owner of these spaces.

On-street Chargepoints should be as vandal and graffiti resistant as possible. CCTV coverage may be available from existing cameras and the sites are usually well lit. However, space for the infrastructure installation is at a premium because it must be installed at the edge of the footway (for further information and requirements please consult the IET Code of Practice for Electric Vehicle Charging Point Equipment Installation). An energy supply may be available from existing feeder pillars. You will not be able to wire into power supplies that are owned or installed by telecommunications companies (usually green boxes marked with a mobile phone company logo and next to a mobile phone mast). On-street infrastructure that is un-branded, clearly not part of traffic light systems, or is DNO-branded are more likely candidates for containing power supplies. Contact the local authority's street lighting department or the relevant DNO.

Many UK households do not have access to private off-street parking, meaning installing a domestic wall-mounted Chargepoint is not practical – the Electric Vehicle Homecharge Scheme (EVHS) grant from the Office for Low Emission Vehicles (OLEV) is only available to homeowners or tenants with access to an off-street parking space. Various solutions have been proposed to overcome this issue. Traditional products are simple charging "posts", however newer innovations are emerging onto the market which provide on-street charging whilst minimising the impact on the pavement space. These include Chargepoints which integrate into lampposts and others which pop-up from the pavement and therefore are hidden when not in use, as well as wireless charging technologies.

4.3 Permission

From UK EVSE's experience, seeking landlord or site owner permission to install Chargepoints is one of the most significant challenges in a project. The UK EVSE Association strongly recommends that you choose sites with a very short landlord permission chain or with no requirement for a legal agreement (e.g. for example a local authority installing Chargepoints on its own land). Otherwise, delays are likely.

4.3.1 Legal agreements

Once you have secured permission from the landlord and/or site manager, you will need to prepare and sign a legal agreement with them. This document should be kept short and simple to minimise the time required for review and authorisation by legal experts representing both parties.

4.3.2 Planning consent

Planning consent (or permission) for Chargepoints is only needed under certain circumstances. There are currently a number of exemptions that apply to Chargepoints under the permitted development rights set out in Statutory Instrument 2056 to make the planning process easier for installations at existing properties or locations. This means an organisation may not need to obtain planning permission for installing Chargepoints at an exempt location. Planning permission will generally be required if a Chargepoint;

- is wall mounted at an off-street location and the unit exceeds 0.2 cubic metres, or;
- is ground mounted at an on-street location and the height exceeds 1.6 metres, or; .
- faces onto and within two metres of the highway, or;
- is within a site designated as a scheduled monument or is within the curtilage (open space surrounding) of a listed building

Usually only rapid chargepoints exceed the height and volume criteria detailed above. The UK Government is expected to consult on a proposal to increase the height limit for the Permitted Development Right in England for the installation of electric vehicle Chargepoints in designated off-street parking spaces.

For further details please see Statutory Instrument 2056.

If you think the location of your Chargepoint is likely to require planning permission, please contact your Council's planning department. You will need to give them details of the equipment and an accurate map of the location. Ordnance Survey maps may be available from the Council, or you may already have plans of the site if the installation is at your workplace.

4.3.3 Advertising consent

Certain Chargepoints come fitted with large screens suitable for displaying advertisements, offering the potential to generate advertising revenue. Generally, if you wish to fit advertising panels or screens to a Chargepoint in a public place, you will need planning permission. Small logos and company details for the Chargepoint supplier and the energy supplier can be fitted to the equipment. Illumination is not permitted, and the logos or advertisements must not exceed 70 square centimetres. For further information please see Statutory Instrument 2057 . If you require planning consent for an advertisement, you must contact your Council's planning department with a copy of what is proposed and where it will be affixed.

4.3.4 Resident or business consultation

If you wish to install Chargepoints in your area or on your land and you think that the installation(s) may impact residents or neighbour businesses in the vicinity, it is a good idea to consult them for their opinion on locations. After doing so, you should consider whether you need planning consent.

If you are looking for sites to install at, or you are a potential investor in Chargepoint installations, you could contact local car dealerships, delivery companies, taxi firms and public sector organisations to determine whether they are interested in EVs, and if they are, where they would find it useful to have access to Chargepoints (in addition to their own premises).

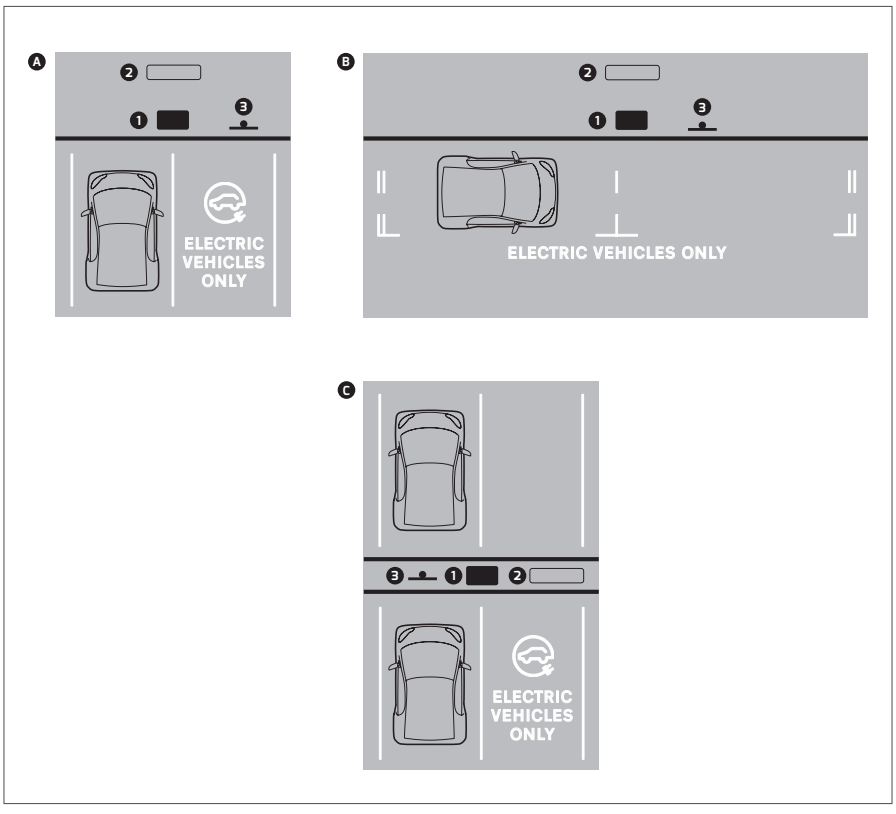
4.4 Location selection

4.4.1 EV parking bay layout

Siting of EV parking bays is usually dictated by the proximity of a metered power supply or passing underground LV mains cable. Once the site has been selected, the layout of the bays must be designed. Fast and rapid Chargepoints with two or three sockets or tethered plugs should be installed in front of and in between two parking bays. The installation should be at the edge of a pavement or other location where charging cables will not be a trip hazard. This layout is suitable where parking is perpendicular to the pavement and (for on-street locations) parallel to the pavement. Please refer to DfT guidelines in document P1032 for marking on-street EV parking bays .

In car parks where there are no pavements and vehicles park nose to nose on two sides, Chargepoints should be sited to serve any of the four adjacent parking bays. It is generally advisable to protect ground-mounted Chargepoints by fitting a crash barrier. These are available in a range of forms. Where a chargepoint is installed in a building or under a canopy, it is also important to ensure that adequate ventilation space is incorporated into the layout. Off-street parking bay markings can be chosen from a variety of designs as there is no single standard for design; however it is advised to use a consistent marking across all Chargepoint parking bays within a local authority or organisation and, where possible, to align these across organisations within a geographic area so as to avoid confusion. Parking bay markings should be designed to make the bays easily distinguishable from other spaces.

Figure 4.0 – EV parking bay layout



HANDY HINTS

Preventing your EV bays from being ICED

It is important to make sure that internal combustion engine (ICE) drivers are deterred from parking in EV bays. You can do this by:

1) Designing the spaces like disabled bays with a hashed area for wider door opening space, but with a different line colouring and an EV logo or text to signify the bays are for EVs only;

2) Colouring the bays differently and applying an EV logo or suitable text to each of them;

3) Providing sufficient EV bays to minimise the impact of ICE-ing; or

4) Locate EV bays away from preferred parking locations, such as near the entrance to a building.

In all of these cases, it is important to install signage that makes it clear what the bays are for and indicating any restrictions on parking (e.g. the time limit (you may wish to impose a time limit to prevent EVs staying in the space when charging has finished), that parking fees apply and that the bays are for EV charging only).

For car parks with four bays accessing a Chargepoint with two sockets (two spaces in front and two at the back of the Chargepoint) general practice is to only mark two bays as EV spaces. Please consider enforcing the bays so that ICE drivers do not park in EV bays.

If you are deciding between wall mounted or floor mounted Chargepoints in a location where there is a pathway between the proposed wall mounting location and the parking spaces, it is advisable to install a ground mounted unit on the edge of the pathway so that you do not cause a trip hazard. Chargepoint controls, display and sockets or tethered plugs, should be placed at a height of between 0.75 metres and 1.2 metres from the ground as per the British Standard on the design of building (BS 8300-1:2018).

For further information on layout please consult the IET code of practice on Electric Vehicle charging equipment installation.

4.4.2 EV parking bay enforcement

Traffic Regulation or Management Orders (TRO/TMOs) are legal documents made under The Road Traffic Regulation Act 1984 and Traffic Management Act 2004 which allow local authorities to manage traffic and parking. Local authorities must consult the public by installing notices and announcing their plans to appropriate media before implementing a TRO or TMO. The public usually has 21 days to respond before the TRO or TMO goes to a Council Transport Committee where it is signed off (termed sealed). For more information on TROs or TMOs please see the Department for Transport website.

CEOs can issue PCNs if there is an on-street TRO or TMO set up to prevent drivers parking ICE vehicles in an EV charging bay or EV drivers parking in an EV charging bay but not charging. No loading or unloading is permitted, Blue Badge holders are not exempt, and there is no observation period. These terms are stated in PCN contravention code 14 for on-street EV charging bays and can be used by any local authority in the UK. London Borough councils, other local authorities, and devolved administrations that have amended their parking enforcement protocols can use PCN contravention code 71 to enforce against ICE vehicles or EVs that are in contravention of a TRO or TMO. The same rules apply as with PCN contravention code 14.

TROs/TMOs are not required for private locations. However, a change to the car park Terms and Conditions of use will be needed, and new signage displayed within the car park to enforce restrictions around use of EV parking spaces. For further details on best practice for private car park operators please refer to the British Parking Association code of practice.

HANDY HINTS

Enforcement of car club parking bays that are also EV charging bays

Some local authorities with car park or on-street fast charging infrastructure and dedicated EV charging bays have offered EV charging spaces to car clubs with EVs. This allows car club members to hire out an EV by the hour or day and then return it to the same spot to charge and for use by another member. This has led to competition between car clubs and members of the general public that own EVs and can cause uncertainty for car club EV users who need to return their hired vehicle back to the car club bay. Conversely, the EV driving public may view car club EVs that are not in use, but plugged in, as taking up valuable EV charging bays that they cannot use. Unfortunately, there are financial implications for the car club if the member parks an EV in a non-car club space where parking fees apply if the EV car club bay is blocked by another car.

The best way to avoid this situation is to increase the number of EV charging bays available to public EVs, make the EV charging car club bays look different from the public EV charging bays (e.g. different bay markings or colours) and install signage warning EV drivers that the bay is for car clubs only. It is now increasingly common for local authorities to designate and enforce car club-only bays – whether EV or otherwise – which prevents this type of issue from arising.

4.4.3 Designing to minimise local impact

It is important that impacts on other road users and pedestrians are considered, as well as wider environmental and wildlife impacts are considered when planning EV Chargepoint installations. The following are common impacts identified by UK EVSE members:

- Chargepoints and associated equipment must not impede pedestrians, including wheelchair users and people with pushchairs. This may mean installing Chargepoints and feeder pillars in line with each other, against a wall or near to other similar infrastructure.
- The visual impact of the equipment should also be considered. In conservation areas (where planning permission for Chargepoints will be required), consider choosing a design that is in keeping with other street furniture.
- It may be desirable to disable the LED indicator lights at certain times of day to help minimise the risk of vandalism and prevent light pollution.
- Signage used to pinpoint the EV parking bays in locations owner or operated by a local authority or the Highways Agency must comply with DfT guidelines. Signage on private land can be of the land owner's choice. Variations of the P660x9 standard EV charging bay sign are commonly used and well recognised by EV drivers and do not unduly affect the site aesthetics (please see Figure 4.1)

Figure 4.1 – The P660x9 EV sign

4.4.4 Ingress Protection (IP) ratings

Where the EVSE is to be located will govern the minimum IP rating required. BS 7671:2018 states that any charging equipment that is to be located outside will have a minimum IP rating of IP44. However, consideration should be given to whether the equipment is likely to encounter regular washing an IP rating of IPX5 would be suitable. Likewise, if the area is likely to be flooded then IPX7 or even IPX8 is recommended. There will be an associated cost to this equipment which should be considered when selecting the location for the equipment.

5.0 Payment: Chargepoint Access and Instant Access Charging

5.1 Introduction

This section explains how an EV driver accesses a Chargepoint and how Instant Access billing works. Legislation now requires all Chargepoints to be available for use by all EV drivers without the need to join a membership network. The Automated and Electric Vehicles Act (2018) is designed to ensure all publicly accessible chargepoints are accessed by the widest section of the population. EU legislation , on which this Act is based, mandates simple ad-hoc access to public Chargepoints and introduced some connection interoperability by mandating specific connectors for Chargepoints. The approaches to comply with the Act are described in the sections that follow.

5.2 Chargepoint access methods

Chargepoints can be open access, with no restrictions on energy usage. This means when an EV driver plugs in their vehicle, charging starts immediately without any further interaction between the driver and the Chargepoint. This type of equipment is typically found at workplaces, hotels and sites that have restrictions on vehicle access. This is a good method of providing 'free' charging for customers and visitors. However, there is usually no means of monitoring energy usage or recovering the energy cost from the user.

Chargepoints in public places or at workplaces with limited control of vehicle access generally have restricted access to charging. An EV driver can usually plug their vehicle in (if the Chargepoint does not have magnetically locked sockets), but charging does not start until they have activated the unit by using an RFID card, smartphone app, or contactless payment.

The most common method of activating a Chargepoint is for an EV driver to touch an RFID card (the unique details of which are registered on the CPMS) to the card reader on the unit and wait for the Chargepoint to respond (and open the magnetically locked socket, if enabled). The driver should then follow any on-screen instructions and start the charging event. The same card must be used to terminate charging. Many CPNOs can add Chargepoint access functionality to an RFID card already used by the driver, such as a fuel card or travel card.

Most CPNOs have released smartphone apps that allow EV drivers to use their smartphone to initiate and terminate charging. In this case, the EV driver parks and scans the QR code on the Chargepoint. If the unit doesn't have a QR code, its details can be found by searching for the site using the postcode or unique identifier number on the Chargepoint. Charging is then started via the app. The phone communicates with the CPMS server to identify the user, and the server then sends a request to the Chargepoint to activate charging. Charging is also stopped via the app; this allows remote termination of the charging event where the CPNO has made this functionality available.

Most new rapid Chargepoints can accept contactless payment by credit and debit cards, and contactless payment enabled mobile phones. In many cases this permits instant access to the Chargepoint, without needing to source an RFID card in advance. Chargepoint units are now becoming available that offer contactless payment functionality at much slower rates of charging, such as 7kW or even 3.6kW. Rapid charge units with contactless payment enabled may also have a chip and pin device for use with older credit and debit cards. Depending on the CPNO and the age of the equipment, the driver may still need to register to use the network, even if they are paying by card or smartphone.

Other access methods which are in various stages of development and trial include SMS text messaging, Interactive Voice Response and coin activated/operated charging. However, these are not widely deployed in the UK. Figure 5.0 on the next page, details the steps involved in utilising a typical Chargepoint.

Figure 5.0 – The steps involved in obtaining a charge from a public Chargepoint

Search for a Chargepoint before starting journey	Use an online Chargepoint map or smartphone app to plan your journey based on where to obtain a charge. Ensure the Chargepoint outlet you intend to use is compatible with your vehicle and operational. Ensure you have the correct charging cable in the vehicle (for non-rapid charging) and the appropriate RFID card, smartphone app or contactless payment solution. Please note that for some networks you may need to register online to obtain an RFID card or set up payment for charging.	
Navigate to Chargepoint and park	Input the Chargepoint location details into your Satnav and drive to the location (ensuring that you have enough charge to get there). Park in a dedicated EV charging bay denoted by bay markings/signage. Note the time limits and parking fee. Pay for parking and obey the parking rules (where applicable). Take the EV cable from vehicle (if applicable).	
RFID card. Present appropriate card to the RFID reader on the Chargepoint and follow the instructions provided. Instant Access Chargepoints will require a payment method to be registered to the User's account when an RFID card is used.	Smartphone application authorised charging Scan the Chargepoint's QR code or search using the application's map, via postcode or unique Chargepoint identifier number on the unit's sticker. Follow the instructions provided. For some networks, instant Access Chargepoints will require a payment method to be registered to the user's account.	Contactless or chip and pin authorised charging Present appropriate card or phone to the contactless reader on the Chargepoint and follow the instructions provided. If the unit has chip and pin functionality, insert card and follow on-screen instructions.
Plug in and start charge	Plug vehicle in when prompted and wait for the vehicle and Chargepoint to acknowledge charging has commenced (e.g. EV dashboard and Chargepoint LED status lights change). If a problem occurs and the vehicle stops charging prematurely, please call the helpline on the Chargepoint for instructions. If it is safe to do so, it may be worth repeating charging initiation to see if charging is possible before calling the helpline.	
Stop charge	Terminate charging using the method you used to start charging. Please note that you must use the same card or phone with which you started the charge. It can also be possible to stop the charge by unlocking the vehicle on charge.	
Unplug	Unplug your vehicle from the Chargepoint when prompted by the onscreen instructions. Close the charging port on the EV, place the detachable charging cable in the vehicle and close the Chargepoint socket or ensure the tethered Chargepoint plug is safely stowed in its holster. In the unlikely event that you encounter a problem during charging, call the helpline on the sticker on the Chargepoint.	

HANDY HINTS

Chargepoint Hosts – Update your site information with your CPNO!

For Chargepoint hosts wishing or obliged to set up Instant Access systems on their Chargepoints, it is important to make sure that the right tariff is chosen based on the location parameters and the service provided. It is the host's responsibility to set this tariff with the CPNO and to carefully observe if tariff changes impact usage. Previous studies in the UK and US have shown that Chargepoint usage can be very price sensitive.

Advertising changes to, or the introduction of, Instant Access tariffs or changes to the access or location of Chargepoints are also the responsibility of the host. Failure to update information can reduce equipment usage and revenue generation.

HANDY HINTS

Chargepoint usage tips

Chargepoints can sometimes be slow to respond to RFID cards or smartphones. This is usually because the connection between the unit and the back-office system has temporarily been lost. In this situation it is best to wait until the unit resets itself and then retry. Some Chargepoints show their connection status on the display which can be a useful tool for the User.

An EV may be physically compatible with a Type 2 AC 43kW tethered plug, but the vehicle may not have an on-board charger capable of accepting the full power output of the charger. Drivers of such vehicles should avoid using rapid Chargepoints out of courtesy for other EV drivers that can take full advantage of the charging speed of the equipment. Other fast charging equipment is usually not far away.

5.3 Revenue generation

Chargepoint hosts can earn revenue from charging equipment to cover electricity costs and repay the initial investment. Depending on the ownership model implemented, the Chargepoint host could receive all or a share of the revenue from charging events, minus any transaction processing fees. Some CPNOs charge an annual fee to the host for the Instant Access service but give the host most of the charging fee back, whereas others do not charge an annual fee but take a cut of each transaction to pay for their services. In some cases, Chargepoint hosts may be tied to a particular CPNO and Instant Access solution if you purchase equipment from a particular manufacturer. See section six for more information on ownership and operating models.

5.4 Measuring Instruments Directive (MID)

If the user(s) of the Chargepoint will be billed for usage, then it is necessary that a metering device compliant with the Measuring Instruments Directive (MID 2014/32/EU) is installed to guarantee the customer is receiving the amount of energy for which they have been billed. Note that a MID-compliant metering device may be supplied as part of the charging equipment as standard or as an optional extra. If not, a separate device needs to be installed. OLEV maintains a list of MID-compliant metering devices.

6.0 Proprietorship

6.1 Introduction

This section is primarily applicable to local authorities and transport authorities planning to provide Chargepoints for fleets and the public but is also relevant to businesses with premises either spread across a geographical area, or with a national footprint, as for example with hotel chains or supermarkets.

The financial viability of a charging infrastructure project can be reduced when a poor business model is chosen. There are a range of business models available, each with their own benefits and drawbacks. Generally, there is a trade-off to be made between risk and revenue; the lower the risk, the lower the potential revenue and vice versa.

6.2 Own and operate

In this model, Chargepoint assets are owned, installed and operated by the host organisation. The host also takes responsibility for maintenance and ensuring the network is reliable. The primary benefit of this approach is that the host retains ownership of the hardware and has full control over the network, including siting and pricing. The host needs to provide a means by which users can access the Chargepoints, which could be either via instant access contactless or chip and pin payment, or by linking to another form of payment card, as for example with a travel card or loyalty card, or by having a CPNO provide a CPMS branded on behalf of the host. This model requires the host to invest in hardware and software support but all available income from the use of Chargepoints goes to the host. The upfront capital and significant expertise to plan, install and operate the network make this a relatively high-risk option.

6.3 External operator

This model is similar to the own and operate model, except a third party is contracted to operate the Chargepoints. This model has traditionally been the most common. A CPNO is contracted to provide a back-office system and assume responsibility for the day to day running and maintenance of the units. The CPNO can offer to make these Chargepoints part of the CPNO wider network as a means of aiding EV roaming. With this model the host has taken a Chargepoint ownership responsibility but delegated operational responsibility to the CPNO based on a service level agreement. The service and maintenance contracts for the Chargepoints are typically made with the original Chargepoint supplier. Chargepoint hardware is typically specified as needing to be OCPP compliant so the host can have the CPNO connect different units into a common network and the host can switch between hardware providers as well as between CPNOs.

6.4 Lease ownership

A typical lease model will be structured such that the Chargepoint hardware is owned by the supplier and is rented or leased to the host. This offers a degree of flexibility as the terms of the lease can be tailored to suit the requirements of the host. For example, the hosting organisation may wish to take ownership of the groundworks and electricity costs, effectively meaning that everything behind the chargepoint is owned by the host, allowing them to transfer to a different supplier once the lease agreement has expired. This mitigates the risk of a contracted operator installing units where it is easiest and cheapest, rather than where they are most needed. The lease ownership model has begun to become more common with the emergence of CPNOs wishing to invest in owning publicly accessible Chargepoints in prime locations to improve their membership scheme offer to motorists.

Any model which involves securing private sector funding allows hosts to deploy EV charging infrastructure with zero or low upfront expenditure. This reduces risk and eases pressure on council budgets. The drawback is that sites can be tied up for a long lease period as it can take many years for the initial investment to be recovered.

6.5 Concession

In a concession model, the groundworks for a range of locations for Chargepoints are constructed and owned by the host and made available for a CPNO to operate from. CPNOs tender to have the operational concession for a fixed number of years. The profits from the scheme can be split between the supplier and the host. This model can provide a good balance of risk and reward, although revenue to the host is lower than in some of the other models and highly dependent on how often the Chargepoints are used and the pricing applied. Note that the comments in section 6.3 about private sector investment also apply in this case.

7.0 EV Chargepoint Project Management

7.1 Introduction

This section introduces the need for project management in a Chargepoint project and discusses likely timescales.

7.2 Project management and work items

If you are an organisation wishing to initiate a Chargepoint project, you must decide whether to manage it yourself or outsource. Small projects of one or two Chargepoints in a few locations may be manageable in-house, though you still need to allocate time to liaise with stakeholders and respond to any issues encountered. For larger projects with multiple sites, it is often necessary to employ a dedicated project manager.

HANDY HINTS

Identifying the ideal EV Chargepoint project manager

EVs are still a relatively new technology and therefore most organisations installing their first Chargepoints will not have a member of staff with EV-specific expertise and/or experience. The skills supply in this sector is also relatively sparse, meaning that external recruitment can be costly and not always successful.

In these cases, it can often be effective to identify a capable and interested member of staff to become an "EV Champion" and ultimately take ownership of Chargepoint installation projects. Doing so will build in-house capability and, for an individual with interest and passion for the subject, this may represent an exciting development opportunity. For larger organisations, an internal "EV Champion" will also have a better understanding of the organisation structure, with knowledge of who to involve, when and where.

The likely work items are listed in Table 7.0 on the next page. Tasks such as finding sites can be done by a combination of in-house staff, the Chargepoint supplier and a consultant. Procurement and host agreement formation and distribution (for other private sites) can be undertaken in-house or with help from a consultant. The Chargepoint supplier will provide the equipment, usually with installation. If a new power supply is required, a project manager will need to coordinate the Chargepoint installer, DNO and energy provider. Sometimes the Chargepoint installer will manage the other parties, but this is dependent on the terms of the contract. Setting Instant Access tariffs and approving installations is normally done in-house. Commissioning the units is the responsibility of the Chargepoint installer and the CPNO. Publicity of the locations (if needed) can be undertaken by a combination of in-house, Chargepoint supplier, CPNO and consultant staff.

Before going out to tender you must work out which items you want to tender for and to whom. This may require several lots to allow different types of businesses to bid for certain tasks. For example, a consultant may be appropriate for finding sites, helping with procurement and monitoring the installation process, but would not necessarily have the expertise to perform the installation. There are a number of standards available that can help with project management including ISO 21500:2012 and ISO 9001 . Some employers train their staff to the Projects in Controlled Environments (PRINCE2) standard.

Table 7.0 – Chargepoint project stakeholders and their suggested tasks

Stakeholder	Stakeholder specific tasks. Tasks in different columns can be undertaken concurrently.	
Host and/or Consultant	Find and survey sites including DNO liaison	Tender setup and documentation distribution
	Liaison with Planners/Parking	Arrange agreement with Landlord (if applicable)
Chargepoint Supplier	Organise detailed site surveys	Organise new energy supply connection (if needed)
	Tender response	
	Equipment supply	
	Organise installation with installer and host	
	Liaison with CPNO and host to provide equipment and site details	
Host and Energy Supplier	Organise installation of new energy meter (if needed)	
Chargepoint Installer and DNO	Install and connect Chargepoint to energy and communications network. Test equipment	Provide equipment and site information to CPNO and host
Instant Access CPNO Service Provider (subscription or non-subscription services)	Equipment setup on CPMS and locations advertised	Liaise with host to determine charging tariff (if applicable)
	Equipment access and Instant Access service tested	Pass details of banking liaison officer to host to implement a host bank account and confirm transaction charge (for contactless and chip & pin payment enabled equipment)
Host and/or Consultant	Visual inspection, access test and sign-off for payment	
	Publicise installations	

7.3 Chargepoint and installation service providers

Chargepoint suppliers might simply deliver the equipment for installation by another contracted organisation. Alternatively, they may provide installation services via their own electricians or an electrical subcontractor. Generally, the more companies involved in the process, the higher the risk of miscommunication or a lack of communication and mistakes being made. It is important to investigate the experience of other Chargepoint hosts when using proposed suppliers. Private sector organisations should contact a local site with Chargepoints to understand their experience. Local Authorities' ability to undertake this type of market research is limited because the tendering process is much more open and transparent. This makes it harder to avoid companies that have provided a poor experience to hosts in other similar projects.

HANDY HINTS

Potential Chargepoint hosts – ask someone in the know

After researching what equipment and services you want, it is worth talking to someone who has already installed or helped others install Chargepoints. They may be able to help identify who should be asked to quote for the equipment and services and share their experience of working with certain Chargepoint Suppliers or Installers. The best sources for such contacts are online Chargepoint maps on CPNO or other websites. Search one or more of these maps for similar Chargepoint installations to your own proposal. Most maps show details about the site and the host, including contact details. If you can't find any similar installations, please contact the UK EVSE Secretariat who may be able to help.

7.4 Timescales

For businesses that wish to install Chargepoints, unless the sites require planning consent or a business to business legal agreement, the project lead time is relatively short because fewer steps are required. However, for multiple-site Local or Public Authority Chargepoint projects, UK EVSE suggests that you start the process of finding Chargepoint sites 6 to 12 months prior to the equipment procurement exercise so that you can allow for the following items;

- Contacting the right people within the organisation(s) involved. These typically include parking, procurement and planning departments;
- Contacting the right people for privately owned sites;
- Undertaking local research on where to install Chargepoints;
- Drawing up of procurement documentation;
- Drawing up of a legal agreement between the relevant organisations;
- Negotiations between Council and host company legal departments over the agreement
- DNO works that can take 12 weeks for a standard connection, or six months or more if significant upgrades are required;
- Equipment supply lead time which can be four to six weeks depending on demand;
- Installer lead time depending upon their schedule

When requesting quotes please make sure that you ask the tendering organisations for a delivery plan including key milestones and a risk register.

HANDY HINTS

Undertake your own site survey

If you have the time and resources available, it is worth undertaking a Chargepoint site survey yourself before contacting a Chargepoint supplier or releasing your tender.

When choosing a site consider whether the equipment will serve your own fleet, public EV drivers, buses and/or taxis. The terms of a grant or other public fund may dictate where the equipment is installed (i.e. with public access).

Identify at least 2 or 3 positions for the Chargepoint in your preferred location to maximise the chance of the installation going ahead. Consider the location of the Chargepoint relative to parking bays, loading bays and other surrounding features. Consider the direction of vehicle movements on e.g. one-way streets and prevent cables trailing over other vehicles or blocking the exit of other vehicles. If the Chargepoint is in a private car park, assess whether you need to change the terms and conditions for using the car park and the signage. If the location is on Local or Public Authority land, assess whether you need to change a Traffic Regulation or Management Order (TRO/TMO). Work out whether the Chargepoint will be wall or ground mounted. Wall mounted points tend to cost less to buy and install.

Choose sites where there is an existing energy supply if possible. If there is no energy supply, you must be willing to pay for a DNO connection that can cost a minimum of £2,500 but is often significantly higher. If there is an energy supply close by, you should seek permission to access it with your electrician and photograph the main fuse rating, the meter and the distribution board (taking note of their parameters). If the distribution board has paperwork attached describing its circuits, make a copy. It is less likely that there will be enough capacity to support g a rapid Chargepoint without additional DNO works.

Measure the distance between the energy supply and the proposed Chargepoint locations and make a note of the distance and how the cable will be routed. The cable will be Steel Wire Armoured and therefore cannot be suspended without metal trunking support and needs a reasonable radius to be bent. It is advisable to indicate whether the cable will be attached to a wall and/or laid under hard or soft ground and over what distance. Underground ducting is expensive, particularly where it involves excavating a road or car park, with costs incurred for utility scans, traffic management and surface re-instatement.

Estimate the mobile network signal strength at each location. This will need to be checked later by the supplier using a dedicated unit to test all networks and data signal strength. Installing Chargepoints in a basement car park is likely to require additional IT equipment and cabling (at a cost of around £1,500 per unit) or a GPRS antenna repeater (at a cost of around £4,000 per unit).

8.0 Price, Procurement and Maintenance

8.1 Introduction

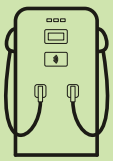
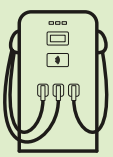
This section provides estimated costs for procuring and maintaining Chargepoints. It lists the capital and revenue items and provides advice on minimising the cost of installation. It draws on UK EVSE's extensive procurement experience to help you write a good tender or quotation request. It explains what you need to ask to make sure you get the equipment and services you need.

8.2 Typical Chargepoint capital equipment costs

Table 8.0 provides estimated costs for most types of Chargepoint excluding VAT, delivery, and installation.

Table 8.0 - Chargepoint types, brief specification and indicative cost

*Variability in costs of a given charger type is due to supplier differences in business model, construction materials, components and component costs.

Chargepoint Type	Typical Specification	Cost Range (£ Ex VAT, Delivery and Installation)
Fast Type 2 Wall Mount 7kW 	▶ Display + LED Status Indicators ▶ GPRS Modem ▶ 7kW, Mode 3 Charger	£750 - £1,500
Fast Type 2 Dual Wall Mount 7kW 	▶ RFID Card Reader ▶ Display + LED Status Indicators ▶ GPRS Modem ▶ 7kW, Mode 3 Charger	£1,700 - £2,700
Fast Type 2 Dual Ground Mount 7kW 	▶ RFID Card Reader ▶ Display + LED Status Indicators ▶ GPRS Modem ▶ 7kW, Mode 3 Charger	£1,700 - £5,000
Fast Dual Type 2 Wall Mount 22kW 	▶ RFID Card Reader ▶ Display + LED Status Indicators ▶ GPRS Modem ▶ 22kW, Mode 3 Charger	£1,800 - £4,000
Fast Dual Type 2 Ground Mount 22kW 	▶ RFID Card Reader ▶ Display + LED Status Indicators ▶ GPRS Modem ▶ 22kW, Mode 3 Charger	£3,000 - £5,000
Rapid Dual Outlet, Type 2 and JEVS G105 	▶ RFID Card Reader ▶ Display ▶ LED Status Indicators ▶ GPRS Modem ▶ 43kW AC or 50KW DC, Mode 3 or 4 Charger	£15,000 - £25,000
Rapid Triple Outlet, Type 2, CCS and JEVS G105 	▶ RFID Card Reader ▶ Display ▶ LED Status Indicators ▶ GPRS Modem ▶ 50KW DC, Mode 3 or 4 Charger	£15,000 - £30,000

8.3 Typical Chargepoint operating costs

Revenue costs include maintenance, servicing, extended warranties, data services and insurance. They are not always covered by Government grants. Table 8.1 provides a guide to expected annual operating costs.

Table 8.1 – Indicative running costs for EV Chargepoints

Item	Cost range (£ Ex VAT)*		Comment
	Fast Charge Point	Rapid Charge Point	
Annual Maintenance Inspection	£100 - £200	£300 - £2,300	Only one site visit per year.
Annual Warranty in year 2 or year 3	£100 - £250	£500 - £2,600	Only covers certain parts under warranty. Will not cover User damage or vandalism.
Annual Warranty in year 4 or year 5 and beyond	£150 - £500	£700 - £3,000	
Annual (Continuous) Data Connection and Collection Fee	£60 - £200	£60 - £300	Covers typical CPNO costs including cost of SIM card and mobile network charges. Covers cost for collection of usage data into database and presentation on web portals. May include PAYG service costs and other charges that are set out in the business plan with the Charge Point Supplier. May not include connection testing for new equipment not tested with the selected CPMS.
Annual Insurance for User damage to Charge Point	Not usually insured; unit re-seating ca. £500 - £1,000 Type 2 socket replacement ca. £300.	Not usually insured; unit re-seating ca. £1,000 - £3,000 tethered cable and plug replacement ca. £300 - £2,000.	The Host usually pays for the correction of issues outside of insurance.
Employers liability insurance cover	Small administration fee to change details of policy.		No significant change in policy costs.
Public liability insurance cover			

* Cost variability reflects differences in supplier business model, competition between suppliers, regional variations in providing service and maintenance (typically more expensive for large rural areas compared with city locations), difficulty of maintenance inspection and cost and number of replacement components required under warranty.

Please consult your insurer for accurate cover costs.

8.4 Chargepoint installation costs

Installation is the most variable cost element in a typical Chargepoint project. As such, we have not provided cost estimates in this document. Chargepoint suppliers and installers will be able to quote for an installation based on site-specific information which you will need to provide. This should include:

- Address (including tested postcode) and exact location details of where the Chargepoints are to be installed;
- E-mail and telephone contact details for one or more people that know and/or are based at the proposed site. This may be a member of Facilities Management, the resident electrician or a member of the parking team (for Councils). Ensure that one person is nominated as the host-side project manager and the main contact;
- Photographs of the proposed location using items such as cones to mark the proposed Chargepoint locations. If the site is not built yet, provide a scale plan marking the locations;
- Any information on an existing power supply including pictures of the fused cut-out, metering, distribution board and location with respect to the Chargepoint site;
- Estimated DNO costs for a new energy supply if needed. This can be obtained from your local DNO;
- Details of the cable distance and where it is likely to go on a wall or underground;
- Details on mobile network signal availability at the proposed locations;
- Drawings for the position of utilities and services in the vicinity of the proposed locations. These may be available from your Facilities Management department or from your architect.

Please also refer to the previous Handy Hints box and Appendix A1.3.

8.5 Chargepoint procurement

The procurement of Chargepoints and other associated items may appear to be straightforward. However, there are a number of pitfalls that an organisation can fall into without performing due diligence on the equipment, supplier, installer, CPMS, CPNO, equipment maintainer and Instant Access business model on offer. There are also several approaches to procuring equipment and services. Public sector organisations are generally required to use a procurement framework or appropriate national or European procurement process. Businesses wishing to buy Chargepoints should ask for quotes from at least three Chargepoint companies.

8.5.1 Quotes and tenders - price

The cost of the Chargepoints, their installation and ongoing (revenue) costs are important. However, some organisations put too much emphasis on minimising the cost of a Chargepoint project. This may reduce the relative importance of reliability and quality of the equipment and associated services in the tender. It is important to strike a balance between the costs of a project and the quality of equipment and services offered for a given price. It is also important to research the companies invited to tender or quote. The tendering organisation should be asked to use pre-collected host survey information (see the previous Handy Hints box and Appendix 1.3) or survey the potential Chargepoint sites themselves prior to submitting a tender response so that they can provide accurate installation costs.

HANDY HINTS

Potential Chargepoint hosts – Ask for installation quotes on a site-by-site basis

Where you are looking at several candidate sites you should ask potential installers to provide separate quotes for installation at each site, based on information you give them. This will help you to choose the most cost effective suppliers and sites. The cost of the equipment should represent no more than 50% of the weighting when assessing quotes or tenders.

The Chargepoint supplier may not need to visit some sites, especially if you (the potential host) have provided enough information on your proposed sites.

Tables 8.2 and 8.3 on the next page outline what component breakdown you may need to ask for and what questions you should ask yourself and, potentially, the supplier and installer quoting for the equipment and services.

Table 8.2 - Chargepoint project capital purchase items – Questions to keep in mind

Capital item (one-off)	Questions to ask yourself as a potential Host
Chargepoint (stand-alone or public network).	▶ Are there any hidden costs such as an energy meter or timer or [1]GPRS modem? ▶ What are the costs associated with the different Instant Access options that the supplier can offer and what costs apply to deliver the service? ▶ Is this cost the same for any powder coating or paint colour? ▶ Does this include network commissioning (if no commissioning cost is given) and mobile network data costs[1]
Bollard or guard (for ground or wall mounted points, respectively).	▶ How many are needed for the project and is the price for one or two?
Signage at parking bays (i.e. P660x9 "EV recharging point only" sign).	▶ Is the price quoted just for the design, or design and delivery? ▶ Does this include the weatherproof panel, sign post, bracket and installation (if standalone)?
Public signage to promote location (i.e. brown Council/blue Highways signs with 565 logo panel).	▶ As above ▶ Does this include the cost of maintaining the sign(s) payable to the Council or Highways Agency?[1] ▶ Does this include any possible licensing/permission/other cost applied by the Council or Highways Agency?[1]
Parking bay markings.	▶ Is this just for the design, or for the design and printing or painting (for preformed thermoplastic and bitumen paint, respectively)
RFID access cards (for mostly public network points).	▶ Is this a one-off cost or is it an annual renewal? How much is an annual renewal?[1]
Equipment delivery to install site.	▶ Who is the shipping organisation? Is this a signed for and tracked delivery?
Installation.	▶ Does this cost include everything to complete and make sure the unit is working? ▶ Does this include alterations to the host's power supply? ▶ If a new energy supply is needed, does it include the DNO cost, feeder pillar, distribution board and meter installation? ▶ Does this include forming the base for the charger, installation of the signs and addition of bay markings?
Back Office connection (for public network points testing and connection of the unit to remote servers by mobile phone network or LAN).	▶ Does this include VPN and APN setup and testing (this is setup and should not include ongoing data costs)?[1]
Switching to another supplier.	▶ Can the Chargepoints be switched to operate under another CPNO without incurring any costs?

[1] Note that this may not be needed for a private, stand-alone, non-monitored Chargepoint.

Table 8.3 Chargepoint project revenue (annual) purchase items – Questions to keep in mind

Revenue item (annual)	Questions to ask yourself as a potential Host
Chargepoint maintenance.	▶ [1]What level of service does this include? ▶ [1]Are there several service options and which will suit me?
Chargepoint warranty.	▶ What items does this cover and not cover? ▶ Can they list the cost of commonly replaced parts?
Data connection.	▶ [1]Does this include the SIM card, GPRS network costs, data collection by the CPMS and presentation to the host and EV user by appropriate means?
Instant Access Service.	▶ [1]Is this with or without a cut of the Instant Access transaction fee (excluding transaction bank costs)? If with a cut, what is the percentage or flat fee taken by the Instant Access service provider per transaction?
Insurance.	▶ Do I need insurance cover for damage to the equipment itself? ▶ How do I go about making sure there is adequate employers and public liability cover in place? What will this cost?

8.5.2 Quotes and tenders - Quality

Table 8.4 on the next page outlines what quality questions you should ask potential Chargepoint suppliers, installers and CPNOs.

Table 8.4 Potential quality questions to ask the tendering/quoting organisation

Question to supplier	Consideration
Do you have previous Chargepoint experience?	▸ Any examples of their previous work in this field? How many examples?
Are you the manufacturer of the Chargepoint equipment?	▸ If the Chargepoint equipment is imported it would be helpful to have reassurances that parts are kept in the UK to allow the supplier to respond quickly to obtain parts to fix faults.
Is the equipment suitable for sale and use in the EU?	▸ Is the equipment CE marked? Is the CE certification from a third party organisation?
Does the equipment meet EV Chargepoint standards?	▸ Is the equipment compliant with standards such as EN61851-1 or other relevant standards? ▸ Is there any evidence provided on the up-time of the equipment?
How does your company treat personal data?	▸ Does the company meet General Data Protection Regulation (GDPR) standards?
Do you keep replacement parts in the UK?	▸ Essentially, can they fix problems quickly? ▸ Can they list the commonly replaced parts?
How long does the warranty last and what does it include?	▸ Is there a list of what is covered and not covered? Can they give you any detail on the cost of commonly replaced parts? ▸ Does the warranty period fulfil my needs?
For public network points	
Do you, or the CPNO, offer Instant Access?	▸ Are they offering a means to obtain revenue from the EV driver that could be used to pay the electricity and any other installation cost?
If Instant Access is implemented, how will I (the host) obtain revenue from the EV user?	▸ What is the mechanism and timescale for payment? Who pays me?
What is the business model for the investor investing in the network?	▸ If there is an investor in the Chargepoints, do they want the user to pay an Instant Access tariff, what cut of the tariff will they take (or what will they charge me) and for how long do they want to be involved? ▸ Does the investor want to own the point(s)? If so, for how long and do I want to relinquish ownership?
What maintenance, monitoring and helpline service levels are on offer?	▸ Do I need to keep an eye on the equipment, or is someone else doing this for me? ▸ Do they offer remote monitoring and fault fixing? ▸ What are their KPIs for uptime, remote fault fixing, and dispatching engineers to site when required?

8.5.3 Public Sector Chargepoint procurement

Public sector organisations must abide by procurement rules and regulations, such as the Public Contracts Regulations (2006) in the UK and, if applicable, EU procurement legislation (Public Contracts Directive 2014/24/EU) . This ensures that all contracts are entered into lawfully and provides good governance on use of public money. The public sector has three main options for high value procurement exercises for Chargepoints. Organisations can use a framework created by another public body, a framework created by a specialist procurement body, or create their own framework.

- A number of Local Authorities, including Nottingham City Council (NCC), have developed their own OJEU compliant public procurement frameworks. This allowed them to create a bespoke framework that could be used by the Local Authority and a range of other public sector organisations.
- An example of a specialist procurement framework is ESPO's Vehicle Charging Infrastructure , a national framework offering public sector bodies access to a pre-qualified list of low emission vehicles and charging solutions suppliers. Products are split over multiple lots and include standard, fast and rapid Chargepoints; installation; back office systems; and maintenance. This offers turnkey solutions for customers to help them access the latest technology.
- Finally, organisations could develop their own framework. This provides a comprehensive and bespoke solution, but a significant amount of time, cost and expertise is required. The potential for delays in delivery due to procurement activities should be mitigated through early engagement with the procurement department, legal services and potential suppliers.

HANDY HINTS

I'm a Local Authority, how do I go about procuring Chargepoints?

If you are a Local or Public Authority, it is worth identifying whether there is a public procurement framework open for use in your area. This should reduce the workload of the procurement exercise whilst adhering to relevant procurement rules. At the time of writing, there were a number of frameworks available for the procurement of Chargepoint equipment and installation services.

If there are no suitable frameworks for your purposes, you can use your own procurement procedures.

8.5.4 Private business chargepoint procurement

Chargepoint equipment purchased by a private business will be used by their vehicle fleet and employees, but very rarely by the general public. Specify Chargepoints and back office services which allow you to monitor usage, including details of the vehicle charged, time and duration of charging event, and energy consumed. This will allow you to monitor Chargepoint usage to determine if heavy usage points toward the need for more Chargepoints. It also allows for the recovery of electricity costs from employees who commute in an EV, or visitors that charge at the site. At the time of writing there were no Benefit in Kind (BiK) implications for staff and therefore no need to recover costs from employees for charging their own vehicles. In future this may change. Rapid Chargepoints should always be connected and monitored by a CPNO or Chargepoint supplier. Whether or not Instant Access is enabled is up to the host company's policy on providing electricity for employee and visitor EVs. Please discuss Instant Access and BiK with your accounts and/or human resources departments and local tax office.

If employees charge a company vehicle at home, you will need a mechanism to monitor energy consumption and reimburse costs. Most Chargepoints and back office systems now offer remote visibility of charging events, including time and duration of charging and energy consumption. This information can be used to accurately reimburse drivers for the electricity used. Some systems allow charging events to be scheduled, to take advantage of cheaper off-peak tariffs. Allowing employees to charge company or operational vehicles at home can offset the need for installing multiple Chargepoints at the workplace. This solution works best for employees with off-street parking, an assigned vehicle, and who own their home. Please consult your local tax office to discuss the implications of this type of scheme.

Private businesses have more flexibility about how they procure Chargepoint equipment and services. Most companies will have a purchasing policy and various contract value levels of sign off for different grades of staff. Companies can opt to use competitive procurement to test the market or when the value of a contract exceeds a certain threshold. Tenders are usually invitation only rather than open bidding processes. Generally, private businesses invite three to five Chargepoint suppliers to tender for equipment and installation. Undertake Chargepoint market and service provider research (as per 6.5.3) and consult internal departments that may be involved in the procurement decision process, project management, or post-installation maintenance and monitoring.

8.6 Chargepoint maintenance and warranty

6.1 Introduction

Chargepoint maintenance must be considered during the procurement process, to ensure the units offer a reliable service to EV drivers. As with all electrical equipment, Chargepoints must be tested at least annually. Testing should include the structural integrity and weatherproofing of the installation, airflow to cooling fans and vents and the condition of sockets and tethered plugs. If the host site does not, or cannot, perform Chargepoint annual maintenance, the host is usually billed for the service by the Chargepoint supplier or CPNO. Maintenance is an annual cost that must not be overlooked. This applies to both publicly and privately owned Chargepoints.

A warranty is important to cover the cost of replacement parts outside of the guarantee period (typically 12 months). Some Chargepoint suppliers offer extended warranties free of charge for one or two years beyond this initial guarantee period. You can use the tender process to specify the warranty period required, though be aware that longer warranties are likely to increase costs. Please check what is covered by the warranty; for example, damage to plugs and sockets caused by misuse is usually excluded.

8.6.2 Who performs maintenance and when?

Annual Chargepoint maintenance must be undertaken by a qualified electrician. This electrician will usually be employed or subcontracted by the Chargepoint supplier. A host electrician must be trained by the Chargepoint supplier before undertaking annual maintenance. If you use your own electrician, you should inform the Chargepoint supplier (and CPNO in some cases) before undertaking maintenance work. You may choose six monthly inspections, but this will cost more no matter who is performing the inspection. For rapid chargers, UK EVSE recommends you use the Chargepoint supplier's appointed maintenance contractor.

8.6.3 Maintenance of publicly accessible Chargepoints

The status of Chargepoints on a public network can be monitored in real time by the CPNO. CPNOs should offer early and proactive detection of faults and remote fixing for simple faults to improve equipment uptime. These services are provided as standard by most CPNOs, but it is important to specify them in any tender so you can be sure you will receive the required KPIs. If you maintain your own equipment you must work closely with the CPNO to inform Chargepoint users about periods of downtime, so they can plan journeys accordingly.

8.6.3 Service Level Agreements for public Chargepoint maintenance

A Service Level Agreement (SLA), should form part of the contract you sign with a Chargepoint supplier or CPNO. This will define what level of maintenance, support and proactive fault detection will be supplied. When writing a tender or asking for a quotation it is important to specify what services you expect from the CPNO and the call-out engineers. Table 8.5 lists what a host could specify in an SLA.

Table 8.5 – What to look out for in a maintenance SLA for public Chargepoint

Service	Action	Response time
Annual inspection.	Including inspection of Chargepoints, feeder pillar, their wiring, weather seals, circuit protection devices and earth continuity. Visual check for sticker and signage issues. Report from inspection to include description of the units checked including serial number, full address, date of installation and last test and pass or fail status with itemised fail list if the unit has failed.	Annual, within 15 working days of anniversary.
Annual communications and data streaming charges.	Linking of the charging equipment to the CPMS and onward linking to other networks (if necessary). Usually three years to be covered.	Connection of the equipment to the CPMS within 15 working days of installation and commissioning. Onward linking to other systems within three months from the final installation commissioning date.
Attend equipment severity 1 incident.	Requires emergency isolation: Investigate and make safe. Carry out emergency rectification works (excluding cost of replacement parts).	Two hours from notification.
Attend equipment severity 2 incident.	Requires action to make the Chargepoint(s) operational: Investigate and carry out operational rectification works (excluding cost of replacement parts).	24 hours from notification.
Attend equipment severity 3 incident.	Requires cosmetic action: Carry out cosmetic rectification works (excluding cost of replacement parts).	Up to 10 days from notification.
User and host issue telephone helpline.	First line response for user issues whilst user is at Chargepoint: Answer calls from hosts or users and guide them through possible remedies that do not require an engineer at site (e.g. trapped plug or other error).	Seven days per week within working hours 08:00-18:00. 24h helpline is desired for public Chargepoint support, but out of hours (18:00-08:00) message service monitored every day during working hours with call back the next working day from the out of hours call might suffice for workplace car parks.
User and host issue telephone helpline requiring engineer callout.	Second line response for Chargepoints that are out of order that cannot be remedied by the first line response team: First line response team to raise a ticket for the Chargepoint engineers.	Immediately after receipt of host or user call for severity 1 Incidents, within 4 hours for severity 2 Incidents and within 8 hours for severity 3 incidents.

Table 8.5 (continued)

Service	Action	Response time
Ticketing system for equipment faults and error reporting.	Ticketing system for issues to be available from the commissioning date of the first installation and used for all issues reported by the Chargepoint host or user. Access or reports to be provided to host.	Ticketing generation times as per helpline. Tickets to be followed up (after action from the engineer) with Chargepoint host within 8 hours of severity 1 incidents, 48 hours of severity 2 incidents, up to 10 working days of severity 3 incidents.
Equipment usage data provision to host.	CPMS supplier to provide remote access to a web portal host to monitor usage. Charging event data to be compiled and presented to funder on a regular basis and if requested by the Chargepoint host.	Remote access available 24/7 and 99% of the time. Charging event reports provided to funder on a quarterly basis as per their schedule. Requests for data reports from host fulfilled within 10 working days of notification.
Optional: Equipment online reservation.	Chargepoints enabled to be booked on-line by user.	Equipment to be placed as reserved for the timeslot allocated immediately on confirmation from user. User reservation to be cancelled when 15 minutes has elapsed from the start of the reservation period without the user accessing the equipment (no-show response).

8.7 - Decommissioning and Disposal

8.7.1 Introduction

It is important to remember that procurement doesn't end when the item has been procured. Purchasers hold a legal responsibility for decommissioning and disposal of assets. It is therefore important to take this into account during the initial procurement and supplier selection phase, so as to avoid any unexpected costs down the line.

8.7.2 Design

Can the chargepoint system be designed to minimise the work, cost and waste related to decommissioning an disposing of the assets? For example, some public charging systems now incorporate generic groundworks – in some cases even separating out the control units (the 'brains' of the charge point) and the plug and assembly, allowing chargepoints to be easily removed and replaced with minimal cost and effort, while also reducing the materials which need disposing of at the end of life.

8.7.3 Recyclability

What proportion of the materials are recyclable and what proportion will go to landfill at the end of the assets useful life? Increasingly, some chargepoint providers are now building their chargepoints out recycled materials, further reducing their environmental impact.

8.7.4 Responsiblity

Who is responsible for decommissioning and disposal should be considered when entering into any proprietorship agreement with third parties. Alternatively, the installer could be contracted to perform any decommissioning work when the Chargepoint reaches the end of its useable life in the same agreement as the Installation work.

9.0 Installation Process

An important part of the successful implementation of EVSE is the installation of the charging equipment.

9.1 – Approved installers

As discussed in section 1.2.2, there are a number of grants available from government which can be used to purchase EVSE. At the time of writing, these included:

- Workplace Charging Scheme (WCS)
- On-street Residential Chargepoint Scheme (ORCS)
- Electric Vehicle Homecharge Scheme (EVHS)

The Office for Low Emission Vehicles (OLEV) maintains a list of approved installers for two of these schemes:

- Workplace Charging Scheme authorised installers
- Electric Vehicle Homecharge Scheme authorised installers

The first step of the installation process is to select and engage with an installer. For WCS and EVHS, it is necessary to use an approved installer to receive the grant funding. There are a large number of approved installers for both schemes so it is likely that the choice will be made based on location (some installers will be local only and others will have nationwide coverage), reputation and price. For larger or more complex installs, we recommend contacting more than one installer to obtain multiple quotations, if possible.

9.2 – Installation electrical requirements

Requirements for the installation of Chargepoints is contained within section 722 of BS7671:2018 IET Wiring Regulations (18th Edition). This latest edition came into effect on the 1st January 2019 and includes updates specific to EV charging infrastructure, particularly concerning requirements for earthing and residual current protection. It is recommended that any installer contracted to do the installation work has been trained to this new standard.

Some of the requirements concerning placement for Chargepoint installation have already been covered in section 4.4 Location Selection. As mentioned in this section the placement of EV charging infrastructure will likely be constrained by proximity to an electrical supply, however there are additional constraints which can affect the location of the infrastructure to ensure the installation is compliant.

For example, the method of electrical earthing for the Chargepoint may influence where the infrastructure can be safely located, depending on the electrical supply to which the equipment is connected, and other surrounding electrical equipment (e.g. street furniture, streetlamps, other buildings). Previous to the 18th edition of BS7671, satisfactory earthing of EV Chargepoints was only recommended if "reasonably practicable". In BS7671:2018, this clause has been removed and, although BS7671 is non-statutory, installers are required to provide a satisfactory means of earthing to be compliant with the 18th edition. This consideration should be managed by the installer. However, as this can affect the installation cost or delay the project if not considered, it is recommended that installers are engaged early. In cases where equipment and installation are being procured from the same provider, early engagement will occur as a matter of course.

Another key change in the 18th edition of BS7671 is the requirement for a Type B RCD or a Type A RCD with 6mA DC fault protection (this is to mitigate the risk of DC fault currents "blinding" a Type A RCD). It is likely that this equipment will be integrated into the Chargepoint itself. If this is not the case, the Chargepoint may be cheaper than competitor models with DC fault protection, but the additional cost will be borne in the installation as the installer will be obliged to install compliant equipment in the Chargepoint connection.

9.3 – Physical installation requirements

Recommendations for where charging equipment should be installed with respect to parking bays is given in 4.4 Location Selection. However, there are other requirements and considerations to take account of during installation, even once the position has been chosen:

- Socket outlet height. In order to comply with BS7671:2018, any Chargepoint socket outlets must be between 0.5m to 1.5m from the ground.
- Display screen outlet height. If the EVSE has a display screen, these are recommended to be between 1.2m and 1.4m above ground, to be viewable by a person standing or sitting down.
- Free space around the charging point – the installer will have to ensure that there is sufficient space around the Chargepoint for ventilation and cooling purposes, and to allow all doors and covers to be opened for maintenance purposes.

- Impact protection. Depending on where the EVSE is proposed to be situated, and who will take proprietorship of the equipment, the owner may mandate that impact protection is installed to protect the asset or impact protection may be required to prevent accidental vehicle damage.
- Bay marking. It may be necessary to mark the parking bay to show that it is for electric vehicle charging. See "Handy Hints" on ICE prevention in section 4.4 Location Selection for more information.
- Bay signage. It may be necessary to provide signage to indicate the parking space is for electric vehicle charging.
- Direction signage. This can be useful to direct users to the charging equipment.

Additional guidance for both physical and electrical requirements is given in the "IET Code of Practice for Electric Vehicle Charging Equipment Installation 3rd Edition" which is updated to align with BS7671:2018.

9.4 – Installation completion

On completion of the installation, the responsible party shall provide the person ordering the work with the following:

- A copy of the Electrical Installation Certificate, complete with schedule of inspections and schedule of test results.
- Advice on any defective parts of the existing installation (if relevant) that have not been rectified – if the installer finds significant defects with the existing installation these can prohibit them from installing the new equipment until the issue(s) have been rectified.
- A demonstration of the operation of the installed equipment.
- Instruction manual for the installed equipment and information of any maintenance requirements.
- The installer will inform the relevant DNO of the installation.

10.0 Publicity and Marketing

10.1 Introduction

Chargepoint publicity and marketing is crucial to inform potential Chargepoint users of your equipment's availability, capabilities and the services provided. You must decide who will have access to your Chargepoint equipment at the start of your project as this will inform the design of the equipment and site. Publicity and marketing can include both employee engagement and education and/or making the public aware that Chargepoints are available for their use.

Whatever you decide to do, you must provide a clear and consistent message to potential users. The information conveyed must be clear about the equipment type and location, access information including time of day restrictions, which network it is on, and what Instant Access solutions are available. To make sure there is consistency you must collect the right information about the site(s) and distribute it appropriately. This must be updated as soon as anything changes and re-distributed as appropriate. For example, if Chargepoints are installed in a car park that then closes for building works, making the equipment inaccessible, you must inform the users (and the CPNO/map providers for public points) that this is the case and when the equipment will be accessible again. Marketing and publicity channels are discussed in the next subsection.

HANDY HINTS

When should I notify mapping services about my Chargepoints?

Please do not inform the National Chargepoint Registry about your Chargepoint project until it is fully commissioned and operational. In the past some planned sites have found their way on to maps before the Chargepoints were commissioned leading to motorists being disappointed and, in some cases, leaving them stranded after running out of charge having navigated to units that are not yet operational.

10.2 Employee engagement

Once Chargepoints have been installed and tested, inform your employees about the location and availability of the equipment, charging rates and compatibility, how they can obtain a charge and whether or not the electricity is free to the end user. This can be done by the usual channels of communication in the business. You may want to consider a Show and Tell event with one or more EVs on show (an example agenda is given in Table 11). This will give staff an opportunity to ask questions and provide feedback on the project. It is advisable to have information on EVs available to employees as it is possible that some employees will not be familiar with the technology. It is now becoming common for employees with EVs using workplace Chargepoints to establish an email or WhatsApp group to keep each other informed of what Chargepoints become available.

Table 10.0 – A typical Chargepoint information event agenda

Item	Comment	Potential contributor
Introduction to EVs.	This is an opportunity to answer a number of questions that employees are likely to have about EVs, their cost of ownership and environmental benefits.	The host, EV OEMs, EV consultant, friendly EV user.
Introduction to Chargepoints.	This is an opportunity to introduce your newly installed Chargepoint(s), why they were installed, who can access them, how easy it is to charge up and what the business model is for running them (if Instant Access is to be instated).	The host, Chargepoint suppler or CPO, friendly EV user.
View EVs and Chargepoints.	This provides an opportunity for people to get up close, look at EVs and try your Chargepoint(s).	Host's own vehicle(s), EV franchise loan vehicles, friendly EV user.
Ride and Drive.	This provides an opportunity for people to try EVs (insurance and permission dependent).	

10.3 Public awareness

Companies that have installed Chargepoint equipment may want to publicise that they are moving to, or supporting, low emission vehicles as part of their Corporate Social Responsibility (CSR) announcements. This can be in company literature, relevant periodicals and at events.

For Local or Public Authorities, the minimum public engagement should include good signage and usage instructions (where applicable) for the EV driver at each site. You should also describe the publicly accessible equipment, its locations and location features (including parking costs) on the Authority's website and the CPNO's website. Maps are very useful in describing the locations. The information you need to gather in order to complete a webpage and map is shown in Table 12.

Your public relations department may wish to write a press release describing the Chargepoint project. Some publications may not be suitable for stories about EVs and publicly funded Chargepoints. Research what other articles they have produced on the subject before approaching a particular newspaper or magazine. UK EVSE can help you find a suitable publication (please contact the Secretariat).

Table 10.1 – Vital Chargepoint location information to gather

Required Item	Comment
Name of the site.	Useful to identify where the Chargepoints are
Latitude and Longitude.	Exact position in Decimal Degrees. A Northings and Eastings transformation tool is available online.
Address including postcode.	The postcode must work and direct the driver to the site.
Access restrictions.	Is there a barrier to the location, does it get locked? Is there a time limitation on the EV parking bays?
Local directions to the Chargepoints.	Description of where the Chargepoints are in respect to recognisable features or landmarks in the vicinity.
Opening hours of the site.	Opening and closing times over seven days for the site. Any planned closures.
Parking fees.	Pay and Display, Pay by Phone or Pay on Foot?
Instant Access.	Service provider, access method and tariff (if applicable).
Contact details for Host.	Tel. number for Chargepoint Host (Switchboard)
Contact details for Instant Access service provider.	Tel. number for Instant Access provider; issue resolution
Contact details for equipment manufacturer.	Tel. number for equipment manufacturer; issue resolution.
Chargepoint ID.	Unique identifier used to allow access by RFID card/smartphone and diagnose faults.
Connector socket/plug compatibility and number of sockets/plugs.	Description of equipment connectors to determine EV compatibility (e.g. Type 2 socket).
Equipment current type and power output.	Description of either AC or DC power output and the current rating in Amps and power in kW.
Chargepoint classification.	Slow, fast or rapid charger.
Image of Chargepoints.	A picture showing the bays and the Chargepoints helping the EV driver to determine the equipment location.

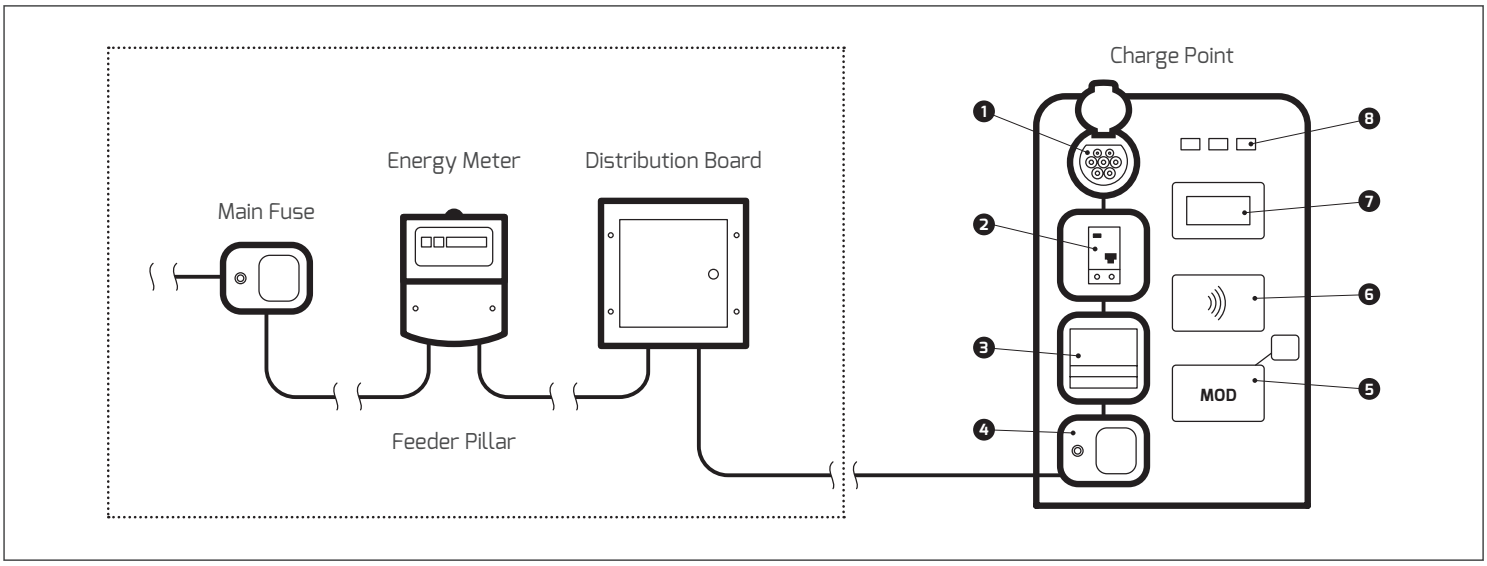
Appendices

A1 Chargepoint equipment components

A1.1 Public fast Chargepoint equipment components

Typically, Chargepoints in a public place will be connected to a feeder pillar energy supply (with its own fuse and Mechanical/ Residual Current Circuit Breaker protection). Each Chargepoint will contain an appropriately rated fused cut out, Residual Current Circuit Breaker with Overcurrent protection (RCCBO) and a Mode 3 charging controller to which a Type 2 socket is connected to. This equipment, except for the fused cut out, is repeated for every socket the Chargepoint contains. For AC three phase Chargepoints, each of the conductors will be protected by an appropriately rated RCCBO. Chargepoints also possess tilt switches and other sensors that automatically cut the power if an abnormal condition arises (such as the unit being knocked over by a vehicle). Figure A1.0 shows the components found in a typical public access fast Chargepoint.

Figure A1.0 – Typical fast Chargepoint components

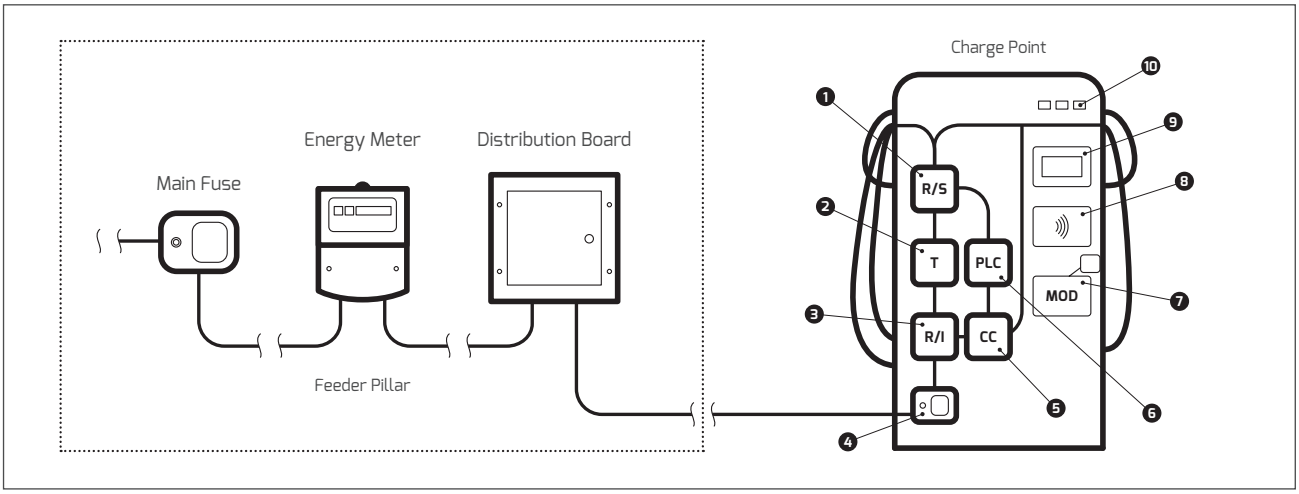


1 – Type 2 socket; 2 – Mode 3 Charging Controller; 3 – RCCBO; 4 – Fuse; 5 – GPRS Modem; 6 – RFID Card Reader; 7 – Display; 8 – LED Indicators.

A1.1.2 Rapid chargepoint equipment components

Rapid Chargepoints contain similar user interface, metering and GPRS modem components to fast Chargepoints. For units that supply both AC and DC energy, the AC side contains similar circuit protection devices, but rated to carry a higher current. A rapid Chargepoint is generally larger than a Fast Chargepoint because it must house the power electronics and circuit protection required to safely and directly charge EV traction batteries (bypassing the EV on-board AC to DC current converter). One other difference is that, due to the high AC and/or DC energy delivery involved, rapid Chargepoints possess tethered plugs. It is impractical and unsafe to carry and use detachable cables rated to carry 63 Amps AC per phase or up to 300 Amps DC. A typical DC rapid Chargepoint installation and its internal components is shown in Figure A1.1.

Figure A1.1 – Typical rapid Chargepoint components



1 – DC converter and power Smoother (R/S); 2 – Isolation Transformer (T); 3 – Converter and Inverter (R/I); 4 – Fuse, surge and RCD protection (AC-side); 5 – Charge Controller; 6 – Power Line Communications Modem; 7 – GPRS Modem; 8 – RFID card reader; 9 – Display; 10 – LED indicator lighting. Please note that DC-side surge and RCD protection have been omitted from the diagram for simplicity.

A1.2 Power supply and site survey requirements

In order to install Chargepoints correctly, it is very important to gather information on the site. It is a good idea to gather site information yourself and then present it to the quoting or tendering companies so that they can provide advice on exact location and cost of installation. Table A1.0 provides an example of what information you need to gather.

Table A1.0 - Information to be gathered during a Chargepoint site survey

Item	Action	Comment
Proposed installation timescale.	Provide details of when you need the equipment to be installed.	Please note that 2-4 weeks may not be enough time for private installations. For public installations requiring consent and agreements, please allow three to 12 months.
Equipment supply only, or supply and installation?	State whether you need a turnkey solution or if you intend to install the unit(s) using your own contractor.	Please note that turnkey solutions are usually the easiest option for the host to choose. This is because product knowledge is very important when installing Chargepoints.
How many EVs need to be charged and how quickly? Do you know which EV model will be charging at the equipment?	State how many sockets or tethered plugs you want (one per EV) and whether you want the vehicles to be charged to 100% in 1h, 2h, 4h or 6h. If you know, state what EVs will be charged at the equipment.	Charging speeds of 4-6h are common as the equipment and installation cost is lower than for Chargepoints that charge EVs in 1-2h (i.e. rapid Chargepoints). Stating the specific EV model to be charged will help the supplier tailor the charging equipment to your needs.

Table A1.0 - Information to be gathered during a Chargepoint site survey (continued)

Proposed equipment location.	Provide details of a few location options for installing Chargepoint(s). Include description of locations and images of the proposed locations marked by cones. Provide site drawings pinpointing locations (if available).	Please include 2-3 sites per Chargepoint and consider the distance to a suitable power supply. You should include pertinent details including: ▸ Location type (e.g. workplace car park, public car park, on-street or domestic) and what the parking is used for; ▸ Access restrictions currently in place (e.g. barrier or locked gates at a certain time); ▸ Parking restrictions (e.g. time limits, parking permit or tariff payment requirements); ▸ Landlord or permissions chain and stage currently at (e.g. permission granted by landlord); ▸ Soft and hard dig lengths for ground units or trunking/cabling length for wall units; ▸ Approximate distance to power supply
Proposed EV user access method.	State which access method the EV driver is to use to gain access to energy. This can typically include open access (plug in only), a key switch or RFID card/smartphone App access or Instant Access.	Open access charging is only suitable for access controlled areas such as at home or in a secure workplace car park. Key switch units are suitable for slightly more open workplace sites and at home. RFID card/smartphone App access is best suited to more open locations where public EV users and/or employees are likely to charge at and there is little supervision or access control.
Power supply availability.	State whether there is a suitable power supply close by and who owns it. Provide details on what capacity the power supply has and what is connected to it. Provide images of the fuses, metering and open distribution cabinet.	If it is your power supply to which the Chargepoint is to be attached to, you should get your electrician to provide details such as whether the supply is single or three phase AC and what the main fuse is rated to. They should also provide information on what is already connected to the supply and what spare capacity there is likely to be. If there is no suitable power supply, please state this and provide details of the DNO contact that you have (if you have this information).
Mobile phone network.	Check signal strength for different networks.	

A1.3 Distribution Network Operators (DNOs)

There are currently seven DNOs in the UK. For an updated list and to find our local DNO please visit the Energy Networks website . Certain DNOs, such as Western Power Distribution, provide an online grid maps portal to which you can register for access and request maps. Others do not offer this service but will be able to check their area database for Low Voltage mains cable locations in the vicinity of your proposed Chargepoint installations for a small fee. If you are a Local or Public Authority, it is worth talking to your street lighting department who should have this information to hand. As mentioned earlier, this type of service/data is useful if there is no known power supply/feeder pillar in the vicinity.

A2.0 Glossary of Terms

Table A2.0 - Glossary

Term	Description
AC	Alternating Current.
Amp or Ampere	A measure of electrical current.
Back Office	Synonymous with CPMS in the context of this guide (see CPMS).
Battery EV or BEV	An EV solely propelled by an electric machine (motor) powered by a traction battery (typically with Lithium ion chemistry). Power for air conditioning and heating is also derived from the traction battery. BEVs are usually conductively charged from the energy grid when stationary.
CANbus	The Controller Area Network bus, or CANbus, is a vehicle data bus standard that allows microcontrollers and other vehicle electronics to talk to each other without a host computer. CANbus uses a message-based protocol with either 11 or 29 bit identifiers and typically provides up to 64 bits of data in its messages.
Capacity	Capacity, in the context of this guide, refers to the amount of energy (in Amps) that can be safely drawn from a circuit without damaging it or items that are attached to it.
Car Club	An organisation (public or private) that owns, leases or gathers vehicles from owners to hire out to vetted and subscribed club members on an hourly basis. Members of large private car clubs usually gain access to a vehicle using an RFID card held to the RFID reader in the windscreen.
CCTV	Closed Circuit TV is a security measure where cameras are installed in car parks and on-street to monitor equipment and public behaviour.
CHAdEMO	CHAdeMO is an abbreviation of CHArge de Move (charge for moving) and is a trade name for a Japanese-originated rapid DC EV charging protocol with a special connector called the Japan Electric Vehicle Standard (JEVS) G105. The layout of the JARI JEVS/G105 plug and socket can be found in EN62196-3. The JARI JEVS/G105 connector is rated to 600 Volts and 200 Amps.
Chargepoint	The upstand or wall unit to which an EV is plugged into encompassing one or more sockets or tethered plugs, the user interface, access control, energy metering and circuit protection.
Chargepoint Management System or CPMS	The back-office functions that control, and control access to, Chargepoints. A CPMS is usually hosted on a secure server and typically holds data on locations of, and sends/receives commands to/from, Chargepoints on the network. Chargepoints are typically connected to the CPMS via a secure mobile telephone network connection and sends/receives commands using a protocol called Open Chargepoint Protocol (OCPP). The CPMS also holds information on authorised users (i.e. their RFID card or membership details) in order to enable charging access to the EV user when the system is requested by a Chargepoint. A typical add-on feature to a CPMS may include Instant Access billing where the authorised user is billed for access to a Chargepoint. The CPMS also monitors the health of, and can perform some firmware/software upgrades to, Chargepoints connected to it.
Chargepoint Network Operator or CPNO	The organisation responsible for running a CPMS and providing hosts and/or EV users with help on access and faults with the Chargepoints on their network. See CPMS for further details.
Circuit breaker	A circuit protection device that opens the circuit when a fault is detected.

Civil Enforcement Officer or CEO	A Civil Enforcement Officer is usually a Local Authority employee or subcontractor tasked with policing streets or car parks under the Local Authority's jurisdiction. They monitor parking, parking infrastructure and issue Penalty Charge Notices (PCNs) to owners of cars that clearly contravene specific parking contravention codes set out by the DfT. Two of these codes (14 and 71) include parking of an Internal Combustion Engine (ICE) propelled non-plug-in car (or even an EV that is not charging) in an EV parking bay.
Combined Charging System, CCS Combo 2	A connector plug and socket and communication protocol package developed/packaged by the Society of Automotive Engineers (SAE). In the EU the Combo 2 connector combines the earth, proximity and pilot pins of the Type 2 plug with two DC specific pins on an added lower section of the plug. The layout of the Combo 2 plug and socket can be found in EN62196-3. The Combo 2 connector is rated to 850 Volts and 200 Amps.
Data encryption	A method of securing data in order to prevent unauthorised access. Encryption typically requires a key or password to decrypt the data in order for it to be readable and useful to the recipient.
DC	Direct Current.
Department for Transport or DfT	UK Government department tasked with road, rail, sea and air transportation policy and incentives.
Electric Vehicle or EV	Typically, an Ultra Low Emission Vehicle (ULEV) with emissions of less than 75g CO_2/km. Propulsion is provided partly or fully by an electric machine (motor) powered by an on-board traction battery and/or ICE generator. Most EVs can partially recharge their traction battery utilising regenerative braking performed by the electric machine.
Energy	Energy, in the context of this guidance, means electricity.
Enhanced Capital Allowance (ECA)	A financial tool and incentive that allows businesses to write off the cost of a purchase for their business against the company's tax bill. This is applicable to EVs and is administered by HMRC. Certain conditions apply for the purchase of electric vans.
Extended Range EV or EREV	Typically, an EV with both an electric machine (motor) and ICE, but with the electric machine (motor) only providing propulsion and the ICE acting as a generator to charge the traction battery. The battery can also usually be charged by plugging the vehicle into the mains when stationary.
Fast charging	Typically, 4-6 hours to charge a 24 kWh traction battery (100% SOC) utilising Mode 3 charging from a single or three phase dedicated circuit using an EV specific charging connector such as a Type 2 (7 pin) or J1772 (5 pin) plug and socket combination on the vehicle side and a Type 2 (7 pin) plug and socket combination on the Chargepoint side. Typically, 16 or 32 Amps single phase AC energy for 6 and 4 hour charging times, respectively. Please note that 32 Amps three phase AC energy can charge compatible vehicles in 1-2 hours.
GPRS	General Packet Radio Service. A mobile data service on the Global System for Mobile communications (GSM). GPRS is utilised by Chargepoints to send and receive commands from a Chargepoint Management System.
HMRC	Her Majesty's Revenue and Customs.
Host	Host, in the context of this guide, means the landowner/landlord of the site where one or more Chargepoints are installed. The host may own the Chargepoint(s) or may simply allow for the equipment to be installed on their land.
IET	Institute of Engineering and Technology
Installation	Installation, in the context of this guide, refers to the fitment and commissioning of Chargepoint equipment and any required ancillary items including crash barriers, signage, parking bay markings, concrete plinths, cable ducting or trunking and circuit protection devices.

Instant Access	Instant Access is a feature of Chargepoint networks allowing the EV user to pay for their charging events either via a pre-paid/loaded account or by monthly/quarterly billing. Instant Access for Chargepoints is similar to the service provided by mobile telephone companies for non-contract mobile telephones.
IP	Ingress Protection (Rating). The rating given to equipment indicating its ability to prevent the ingress of foreign bodies (liquid and solid).
JARI	Japan Automotive Research Council.
kW	A unit of electrical power.
kWh	A unit of power storage in an EV traction battery. It refers to the capability of the battery to provide the stated kW in one hour at 1C (capacity rating).
Local Authority or LA	Borough, City or County Councils funded by the UK taxpayer tasked with civic duties to maintain public assets and services for residents and visitors to/in their jurisdiction.
Local Sustainable Transport Fund or LSTF	A fund provided to successful Local Authorities that bid into the DfT to improve the sustainability of transport (socially and environmentally) in their area. Most bids included support for cycling, but fewer stated that they would support EVs and EV charging.
MID	Measuring Instruments Directive 2014/32/EU
Mechanical Circuit Breaker or MCB	A circuit protection device that opens the circuit to which it is connected when a fault condition such as a short circuit or circuit overload occurs.
Meter Point Administration Number or MPAN	An MPAN is a unique 13 to 21 digit code allocated to an energy grid connection to which one or more energy meters are attached to. An MPAN number is provided to the host of a new energy supply by the District Network Operator (DNO) and is used when organising a new meter to be installed by an energy supplier. The number may also be found on an energy bill for the site.
Mode 1 charging	Typically, AC EV charging using a domestic or industrial connection on the energy grid side (i.e. BS1363-1 three pin domestic or EN60309-1 three/five pin Commando connections in the UK) without a pilot signal and up to 16 Amps and 250 Volts single phase or 480 Volts three phase only. The connection utilises the power and protective earth conductors.
Mode 2 charging	Typically AC EV charging using a domestic or industrial connection on the energy grid side (i.e.BS1363-1 three pin domestic or EN60309-1 three/five pin Commando connections in the UK) with a pilot signal between the EV and an in-line control box (the "brick" placed 30 cm from the plug) and RCD protection either in the control box or as part of the cable assembly (i.e. the RCD could be integrated into the plug that connects to the Chargepoint). AC energy should not exceed 32 Amps and 250 Volts single phase or 480 Volts three phase. The connection utilises the power and protective earth conductors.
Mode 3 charging	Typically, AC EV charging using a dedicated charging cable and connectors (e.g. a J1772 or Type 2 plug on the EV side and a Type 2 plug on the Chargepoint side of the cable; as defined in EN62196-2). The pilot signal conductor extends between the EV and the Chargepoint. Typical charging currents range from 13 Amps single phase to 32 Amps three phase for cables that are detachable from the Chargepoint. Rapid chargers utilise the Type 2 tethered plug at 63 Amps three phase. The level of charging current depends on the Chargepoint output and the EV's on-board charger.
Mode 4 charging	Typically for DC EV charging using a dedicated connector tethered to the Chargepoint connected to the energy grid AC supply. The charging circuitry is off-board and can be found within the Chargepoint. The pilot signal conductor extends between the EV and the Chargepoint. Typical rapid Chargepoint DC energy output ranges from 20 to 350 Amps and 400 to 600 Volts depending on the Chargepoint, the connector type and the EV.

Off-board	Off-board, in the context of this guide, means off-vehicle (not carried on the vehicle).
OLEV	The Office for Low Emission Vehicles, a Government department formed of staff from the Department for Transport (DfT), the Department for Business, Innovation and Skills (BIS) and the Department for Energy and Climate Change (DECC). OLEV is tasked with providing policy and monetary incentives to reduce emissions from UK road transport.
On-board	On-board, in the context of this guide, means on-vehicle (carried on the vehicle).
Open Chargepoint Protocol or OCPP	Open Chargepoint Protocol is an application protocol for communication between Chargepoints and their CPMS. It does not define the communication technology. The protocol was developed by E-Laad in the Netherlands. OCPP describes a number of commands (requests and confirmations) that a Chargepoint and CPMS should use to perform certain functions including monitoring unit health and Chargepoint reservation (reservation only available in Version 1.5).
Overcurrent	Overcurrent is a term used when a connected appliance draws more AC energy from a circuit than the circuit is rated (in Amps) to carry. The absence of overcurrent protection can result in appliance and cable overheating and fire.
Penalty Charge Notice or PCN	A Penalty Charge Notice is a fixed penalty notice issued by Civil Enforcement Officers to the driver of a vehicle that has contravened one or more parking contravention codes. See CEO for further details.
Permitted development rights	Permitted development rights are derived from the Town and Country Planning Order (General Permitted Development) 1995 as amended. A permitted development right means that planning permission for the specific alteration to a property or installation need not be sought from the relevant Local Authority as long as the conditions set out in the relevant statutory instrument pertaining to the alteration are adhered to.
Pilot signal	A +12V to -12V 1kHz square wave signal carried by a dedicated pilot signal conductor within an AC charging cable assembly. The pilot signal voltage state change determines the "handshake" stages between the EV and a Chargepoint in Mode 3 charging. The width of the square wave in state C (ready mode; +6V) determines the current the EV's on-board traction battery charger requires.
Plug-in	Refers to the feature of an EV allowing it to be plugged into the energy grid to charge its traction battery and provide power to the air conditioning or heating when stationary (without depleting the traction battery).
Plug-in Car and Van Grants	Monetary Point of Sale incentives provided by OLEV to encourage the uptake of Plug-in EVs.
Plug-in Hybrid EV or PHEV	Typically, an EV with both an electric machine (motor) and Internal Combustion Engine that can provide propulsion in parallel with each other. The vehicle typically bears a smaller traction battery than a BEV which can be charged by the ICE generator and by plugging it into the energy grid when stationary.
Power Line Communication or PLC	Power Line Communication refers to the ability for data to be transmitted as a signal on the back of existing energy conductors
Power supply	The electricity grid source of energy for one or more Chargepoints at a defined location. Typically formed of a fused, metered connection with a distribution board to which Chargepoint circuits are attached.

Proximity pin	The pin and circuit on an AC EV charging cable plug that disables the movement of the vehicle when a charging cable is plugged into the EV, "announces" the cable's current carrying capacity and disconnects charging when the resistance in the proximity circuit changes. On AC EV charging cables with a J1772 plug that plugs into the vehicle socket, the switch that is depressed (before removing the plug) alters the voltage in the proximity circuit between the proximity pin and earth. This change signifies to the Chargepoint and EV to disconnect the live conductor(s). The cable will also typically have a Type 2 plug at the Chargepoint end with another circuit between the proximity pin and earth containing a resistor that denotes the current carrying capacity of the cable. In AC EV charging cables with two Type 2 plugs, the proximity pin circuit to earth (with resistor) is repeated at both ends of the cable and performs the same function as above, but there is no button to depress before removing the plug from the vehicle or Chargepoint.
Public Authority	Public organisations funded by the UK taxpayer providing public services. Examples include the NHS, Police and Fire Services.
Radial circuit	A radial circuit, in the context of this guide, is a single circuit connected to a distribution board with the sole purpose of providing electrical energy to a Chargepoint. No other appliances are connected to this circuit and the circuit is usually appropriately protected by suitably rated RCCBOs for the output of the Chargepoint.
Rapid charging	Typically, up to 1 hour to charge a 24 kWh traction battery (0-100% SOC; 30 minutes to 80% SOC) utilising Mode 3 or Mode 4 charging for AC and DC energy rapid charging, respectively. Rapid chargers typically have tethered plugs of the JARI JEVS/G105, Combo 2 (both DC) and Type 2 (AC) varieties. Please see the specific glossary descriptions for each connector type.
RCBO or RCCBO	Residual Current Circuit Breaker with Overcurrent protection. Typically, a circuit safety device that opens the circuit when it detects: 1) an energy imbalance between the live and neutral conductors; 2) a temperature rise in the live conductor as a result of equipment drawing too much AC energy.
RFID card	Radio Frequency Identification card. A card holding information that is wirelessly read to identify its user. For Chargepoints, an RFID card provides authentication to activate and terminate an EV charging event at equipment with access control.
Service Level, Service Level Agreement or SLA	Service Level, in the context of this guide, normally refers to the level of bought-in services to keep EV charging equipment maintained and functional. A Service Level Agreement sets out the expected level of equipment monitoring, maintenance requirements (including intervals), warranty coverage and timescale and who is responsible for providing these services.
Slow or Standard charging	Typically, 8 to 12 hours to charge a 24 kWh traction battery (0-100% SOC) utilising Mode 1 or Mode 2 charging from a dedicated circuit and a standard domestic or industrial single phase AC plug and socket (BS1363-1 or EN60309-1). Typically, 10 to 13 Amps single phase AC energy.
SMS	Mobile telephone Short Message Service commonly termed text messaging.
Statutory Instrument or SI	A form of UK Government legislation that allows the provisions of an Act of parliament to be brought into force or altered without Parliament having to pass a new Act.
Ticketing	Ticketing, in the context of this guide, means a CPMS feature that allows Chargepoint faults to be logged and their resolution progress and timeline to be monitored by the CPNO. This feature is particularly useful to the host for ensuring that Chargepoint faults are corrected quickly. It is also useful for CPNO employees, that may not be initially aware of the specifics of each fault case, to become up-to-speed in a short space of time in order to assist in fault resolution.

Traction Battery	The main battery providing energy to the electric machine (motor) for EV propulsion. Typical EV battery chemistries include Lithium ion or Nickel metal Hydride, depending on the vehicle type (i.e. BEV or PHEV).
Traffic Regulation Order or TRO and Traffic Management Order or TMO	A Traffic Regulation Order is an order created by a highway authority (i.e. a Local Authority) outside of London that allows restrictions to be put in place on traffic and parking. Traffic Regulation Orders are borne out of the Road Traffic Regulation Act 1984 and the Traffic Management Act 2004 (as amended) formed by Government. There are three types of TRO and TMO including permanent, experimental and temporary orders. Traffic Management Orders are synonymous to Traffic Regulation Orders with one exception, TMOs usually apply in London.
Type 2	Type 2 is a reference to the dedicated EV charging plug and socket adopted by the UK and EU for AC EV charging. It is defined in the EN62196-2 standard. It holds seven pins/ferules and is capable of delivering single or three phase AC energy (depending on the Chargepoint/EV that it is connected to). It is rated to handle 63 Amps per phase on a three phase connection or 70 Amps on a single phase connection. It can be found as part of cable assemblies carried in EVs or permanently attached to a rapid charger. Most public Chargepoints offering AC energy up to 32 Amps per phase accept the Type 2 plug. Some EVs also possess Type 2 sockets, but with an inversion of the gender so that the two ends of the EV charging cable are Type 2 compliant, but of different genders.
UK EVSE	The UK Electric Vehicle Supply Equipment Association formed of Chargepoint suppliers, Chargepoint test equipment suppliers and Chargepoint Network Operators (CPNOs). UK EVSE holds quarterly Executive meetings discussing industry relevant issues and solutions and Government funding. The group is membership based and self-governing.
Ultra-rapid charger	A ultra-rapid charger is capable of providing a 50% charge to an 85 kWh traction battery in around 20 minutes. The connector can either be a modified tethered Type 2 plug (in the case of Tesla) or a CCS plug and socket. Ultra-rapid chargers deliver DC energy at up to 335 Amps and 450 Volts (135 kW) to compatible vehicles.
Umbrella Chargepoint Management System or uCPMS	A Chargepoint Management System that connects a number of separate Chargepoint Networks (each, themselves, connected to a CPMS). Its aim is to allow roaming charging access for EV users wishing to charge in different regions or countries using one RFID card, smartphone App, IVR or SMS system. An uCPMS usually also has a clearing house function to enable EV users to pay the relevant network via the uCPMS' payment solution.
Virtual Private Network or VPN	A Virtual Private Network is a network that uses the public communications infrastructure (including the internet) to allow secure remote access to computers, servers and Chargepoints.
Volt	A measure of electrical potential difference between the live and neutral (or ground) conductors in a circuit.
Whitelist	A whitelist is typically a list of authorised RFID card numbers (encoded on the RFID chip of each card) that Chargepoints hold or access from the CPMS in order to allow the EV user to obtain a charge when the card is presented to the Chargepoint RFID card reader. Conversely, a blacklist is a list of RFID cards that have been marked as unauthorised to use the network for various reasons.

A2.1 Normative References

Table A2.1 – Normative references

Reference	Description
EN61851-1	Electric vehicle conductive charging system – Part 1: General requirements
EN61851-23	Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station.
BS8300	Design of buildings and their approaches to meet the needs of disabled. Code of practice.
BS1363-1	13 A plugs, socket-outlets, adaptors and connection units. Specification for rewirable and non-rewirable 13 A fused plugs.
BS7671	Requirements for electrical installations – IET wiring regulations – Seventeenth edition (and amendment 2: 2013).
EN62196-2	Plugs, socket-outlets, and vehicle couplers – conductive charging of electric vehicles – Part 2: Dimensional compatibility and interchangeability requirements for AC. pin and contact-tube accessories.
EN62196-3	Plugs, socket-outlets, and vehicle couplers – conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and tube-type contact vehicle couplers.
EN60309-1	Plugs, socket-outlets and couplers for industrial purposes. General requirements.
ISO15118-1/2/3	Road vehicles – Vehicle to grid communication interface – Part 1: General information and use-case definition/Part 2: Network and application protocol requirements/Part 3: Physical and data link layer requirements.

Table A2.2 – Other references

Reference	Source
British Parking Association (Approved Operator Scheme) Code of Practice (2014)	www.britishparking.co.uk
Directive 2014/24/EU. The Public Contracts Directive (2014)	www.eur-lex.europa.eu
IET Code of Practice for Electric Vehicle Charging Equipment Installation (2012) ISBN: 978-1-84919-514-0	www.theiet.org
Projects in Controlled Environments (PRINCE2). Axelos Global Best Practice (2013)	www.axelos.com
The Public Contracts Regulations (2006)	www.legislation.gov.uk
The Road Traffic Regulation Act (1984)	
The Traffic Management Act (2004)	
The Town and Country Planning (General Permitted Development) (Amendment (England) Order. Statutory Instrument No. 2056 (2011)	
The Town and Country Planning (General Permitted Development) (Amendment (England) Order. Statutory Instrument No. 2057 (2011)	

Factsheet Number	Name
1	UK EVSE Charge Point Grant Funding
2	UK EVSE National and Local Government Support for EV Charge Points
3	UK EVSE Electric Bus Charging
4	UK EVSE Charge Point Usage Revenue
5	UK EVSE Obtaining Landlord Permission for your Charge Point
6	UK EVSE Public Charge Point Procurement
7	UK EVSE Procurement – What You Need to Ask

Notes

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