
matt:e
Caring about your World

Why do I need an EV protection unit from matt:e ?

PME (TNCS) is the most common form of earthing provided at new installations and utilises a single conductor for the neutral and earthing functions (PEN) with an earth terminal derived from the neutral cable

The danger arises if there is an open PEN conductor within the network.

This can lead to an electric shock if any metallic parts, including gas pipework and any bonded appliance were touched by a person in simultaneous contact with general mass of Earth

Unfortunately, MCB’s and RCD’s currently used do not detect this fault and do not offer any protection

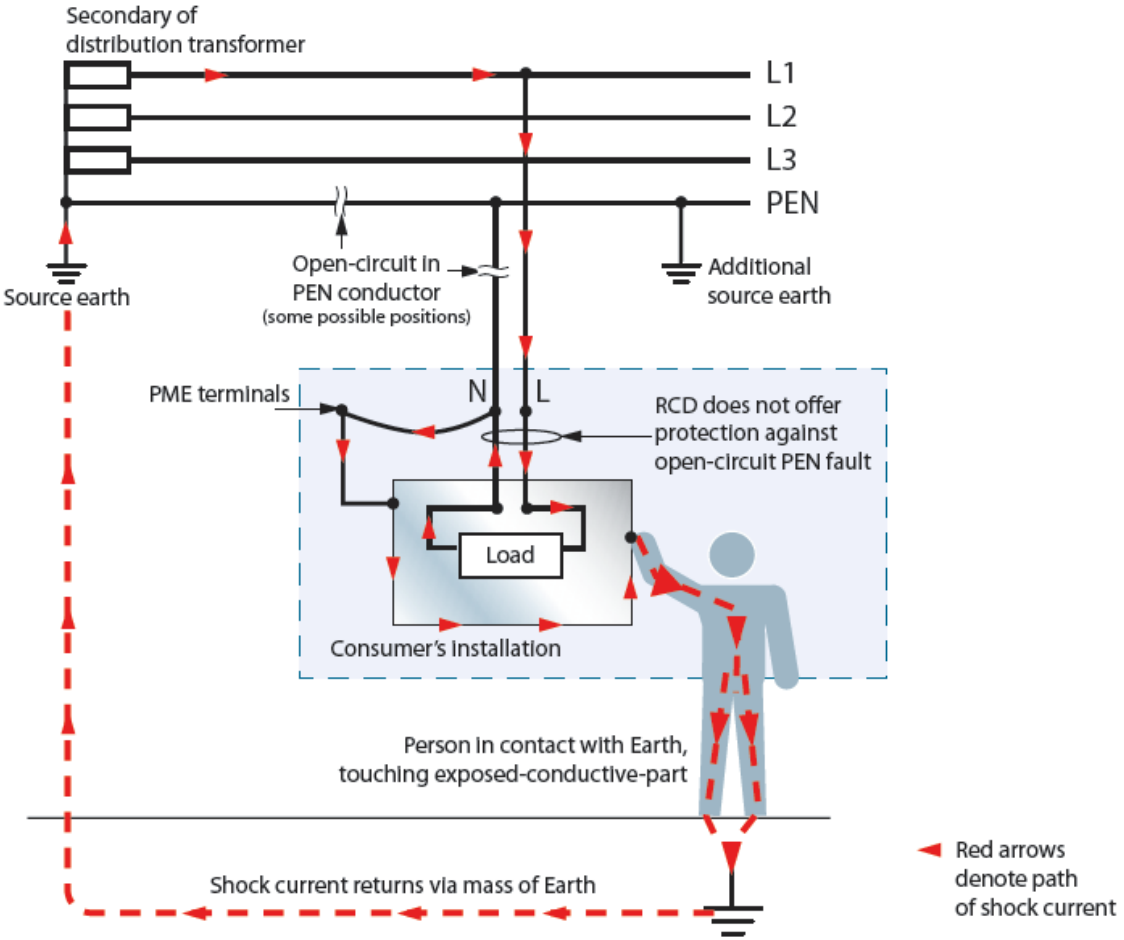


Fig 3 Electric shock risk due to open-circuit fault in the supply neutral PEN conductor

In accordance with the IET Wiring Regulations BS:7671 2018 Amendment 1: 2020, 722.411.4.1 a PME earthing facility shall not be used as means of earthing for the protective conductor contact of a charging point located outdoors or that might reasonably be expected to be used to charge a vehicle located outdoors.

Unless one of the following methods is used

- (i) The charge point forms part of a three phase installation that also supplies loads other than for electric vehicle charging and, because of the characteristics of the load of the installation, the maximum voltage between the main earthing terminal of the installation and Earth in the event of an open-circuit fault in the PEN conductor of the low voltage network supplying the installation does not exceed 70 V rms.

The Problem

Annex A722 of BS 7671 provides calculations to be used where the loading on the phases is balanced. Annex J in the Code of Practice provides a rule of thumb which may be used where power factors on each phase are similar, and the effects of triple harmonics can be ignored.

Note: It is strongly recommended that this method is not used without suitable robust calculations to back up the load data. For existing installations, suitable data may include a 6 -12 month load profile.

- (ii) The main earthing terminal of the installation is connected to an installation earth electrode by a protective conductor complying with Regulation 544.1.1. The resistance of the earth electrode to Earth shall be such that the maximum voltage between the main earthing terminal of the installation and Earth in the event of an open-circuit fault in the PEN conductor of the low voltage network supplying the installation does not exceed 70 V rms.

The Problem

- When driving Earth rods into the ground there is an inherent risk of striking buried services. It is not always possible to accurately detect the presence or position of buried services using detectors and scanning equipment used for underground services surveys.

- Achieving the correct resistance values for the earth electrode as described in A722.3 would be extremely difficult to achieve

Points to consider when installing Earth electrodes

Before a TT system is installed, a risk assessment **must** be carried out so that risks of simultaneous contact with electrical installations, including other street furniture with PME earthing, are minimized (see Annex C).

Generally, this will require the charging equipment to be installed in a location that **ensures that both the exposed-conductive-parts of this equipment, and the vehicle on charge, are at least 2.5 m from other structures with exposed metalwork that are either connected to true Earth or connected to any other electrical earthing system; and any extraneous- or exposed-conductive-parts of any other item of electrical equipment.**

In addition, the TT earth electrode must be adequately separated below ground from buried metalwork connected to the PME earthing system, including:
(a) PME earth electrodes;
(b) supplementary earth electrodes for equipment supplied by the PME earthing system;
(c) exposed-conductive-parts of equipment supplied by the PME earthing system;
(d) metallic sheaths of cables; and
(e) exposed-conductive-parts of installations supplied by the PME earthing system.

The separation distance below ground should be at least 2 m (see Annex H, Table H1). Some distribution network operators may have greater separation requirements.

NOTE 6 of Amendment 1 states that Creating a TT earthing system for charging equipment or the whole installation as an alternative to using a PME earthing facility with one of the methods (i) to (iv) above may not be an appropriate solution due to the inability to provide sufficient separation from buried metalwork connected to the supply PEN conductor

- (iii) Protection of electric shock is provided by a device which electrically disconnects the vehicle from the live conductors of the supply and from protective earth in accordance with Regulation 543.3.3.101 (ii) within 5 s in the event of the voltage between the circuit protective conductor and Earth exceeding 70 V rms due to an open –circuit fault in the PEN conductor of the low voltage network. The device need not operate if the voltage exceeds 70 V rms for less that 4 s. The device shall provide isolation and be selected in accordance with table 537.4. Closing or resetting the device shall be possible only if the voltage between the circuit protective conductor and Earth does not exceed 70 V rms. Equivalent means of functionality could be provided within the car charging equipment.

Annex 722, item A 722.4 gives guidance on voltage monitoring device described in Regulation 722.411.4.1 (iii) and describes a device that measures the voltage between the circuit protective conductor of the electric vehicle charging equipment and Earth. During a PEN failure in the supply network, the neutral of a TN-C-S supply is no longer considered to be reliably connected to Earth, and a device that measures the voltages between the following points **will fail to provide** equivalent safety to the device described in Regulation 722.411.4 (iii):

(i) The circuit protective conductor and neutral

(ii) The circuit protective conductor and the consumers main earthing terminal

Suitable arrangements include measurement of the voltage between either:

(a) The circuit protective conductor and a suitable measurement earth electrode, or

(b) The circuit protective conductor and a reference point derived from the line conductors of a three-phase systems, provided that suitable precautions are also to disconnect the device when the supply to one or more-line conductors is interrupted.

(iv) Protection against electric shock in a single phase installation is provided by a device which electrically disconnects the vehicle from the live conductors of the supply and from protective earth in accordance with regulation 543.3.3.101 (ii) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms. The device shall provide isolation and be selected in accordance with Table 537.4. Equivalent means of functionality could be included within the charging equipment. Closing or resetting of the device shall be possible only if the voltage between line and neutral conductors is in the range 207 to 253 V rms.

Please note;

BS 7671 does not permit a protective device as described in indent (iv) of Regulation 722.411.4.1 to be used to protect single-phase charging equipment in three-phase installations.

Equally, BS 7671 does not permit charging equipment containing equivalent functionality to that described in indent (iv) of Regulation 722.411.4.1 to be installed in installations with three-phase supplies.

(v) Protection against electric shock is provided by the use of an alternative device to those in (iii) or (iv) which does not result in a lesser degree of safety than using (iii) or (iv).

" Does not result in a lesser degree of safety" is the key statement from (v) which any device currently on the market or that may be invented in the future must adhere to.

(iii) Closing or resetting the device shall be possible only if the voltage between the circuit protective conductor and Earth does not exceed 70 V rms

(iv) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms

For isolation from the supply during a fault condition; The device shall provide isolation and be selected in accordance with Table 537.4.

How do matt:e devices comply with the regulations ?

All protection devices have been designed to comply with the operational parameters set out in BS:7671 2018 : Amendment 1 : 2020 Regulation 722.411.4.1 indents (iii) and (iv) offer isolation from the supply in line with table 537.4 and have been independently tested to conform with the relevant Union harmonisation legislation: Low Voltage Directive (2014/35/EU)

The following harmonised standards and technical specifications have been applied:

EN61439-2 : Low-voltage switchgear and control gear assemblies.
EN60947-4-1 Low-voltage switchgear and control gear
EN61009-1 Residual current operated circuit-breakers with integral overcurrent
EN60255-1 2010 Emissions standard for Measuring Relays and Protection Equipment
EN55011 Class A 2011 + A1:2017 Emissions Standard for ISM Equipment
EN60255-26 2013 Immunity standard for Measuring Relays and Protection Equipment,
EN61000-4-2 2009 ESD Requirements
EN61000-4-3 2006 + A1 + A2 Radiated Susceptibility
EN61000-4-4 2012 Electrical Fast Transient Burst Requirement
EN61000-4-5 2006 Surges Requirements
EN61000-4-6 2009 Conducted Susceptibility
EN61000-4-11 2004 Voltage Dips and Interruptions

Three phase infrastructure

The O-PEN is able to detect load imbalances under all conditions including open PEN on three phase PME infrastructures and safely isolates the incoming supply or electrical loads.

This helps prevent the risk of electric shock if dangerous touch voltages occur above 70V fully compliant with BS:7671: 2018 amendment 1: 2020 Regulation 722.411.4.1 (iii)

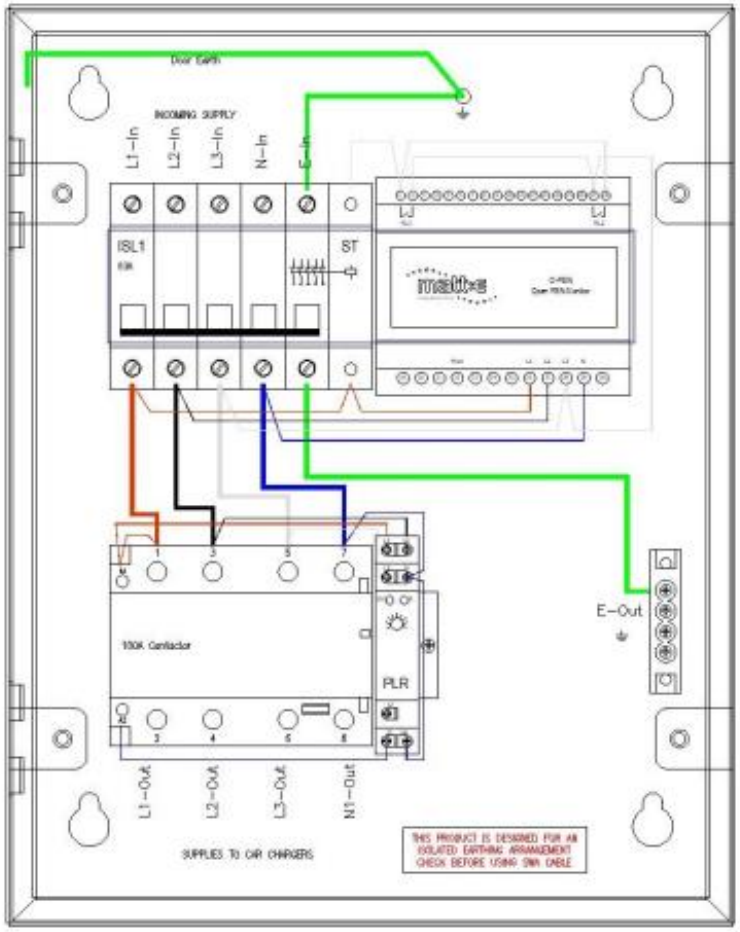
EV connection centres for 3 phase infrastructures.

- Simple wire in wire our connection
- Multiple configurations to suit most installations

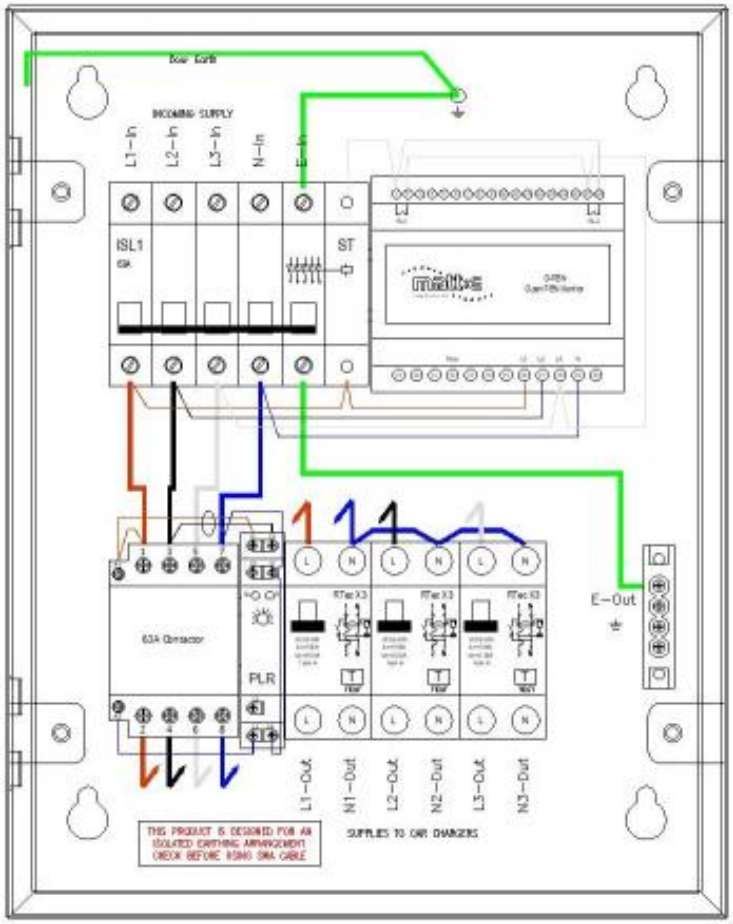
EV-3-32-R

EV-1-32-TP-R-
3-32SP-R

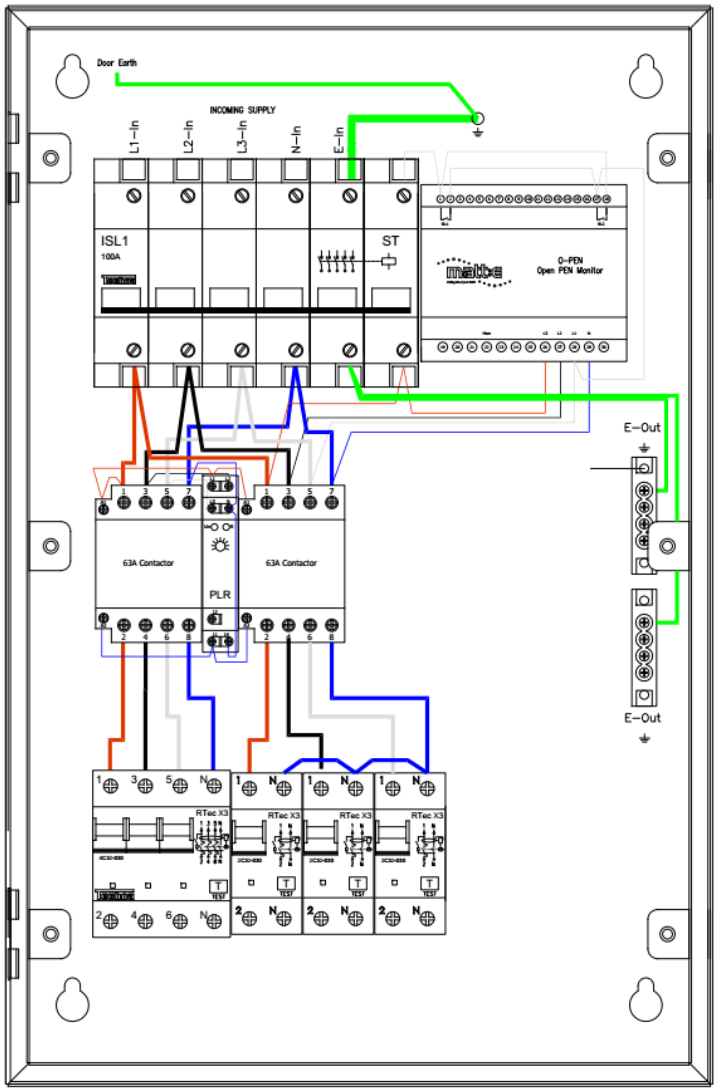
Typical product layout

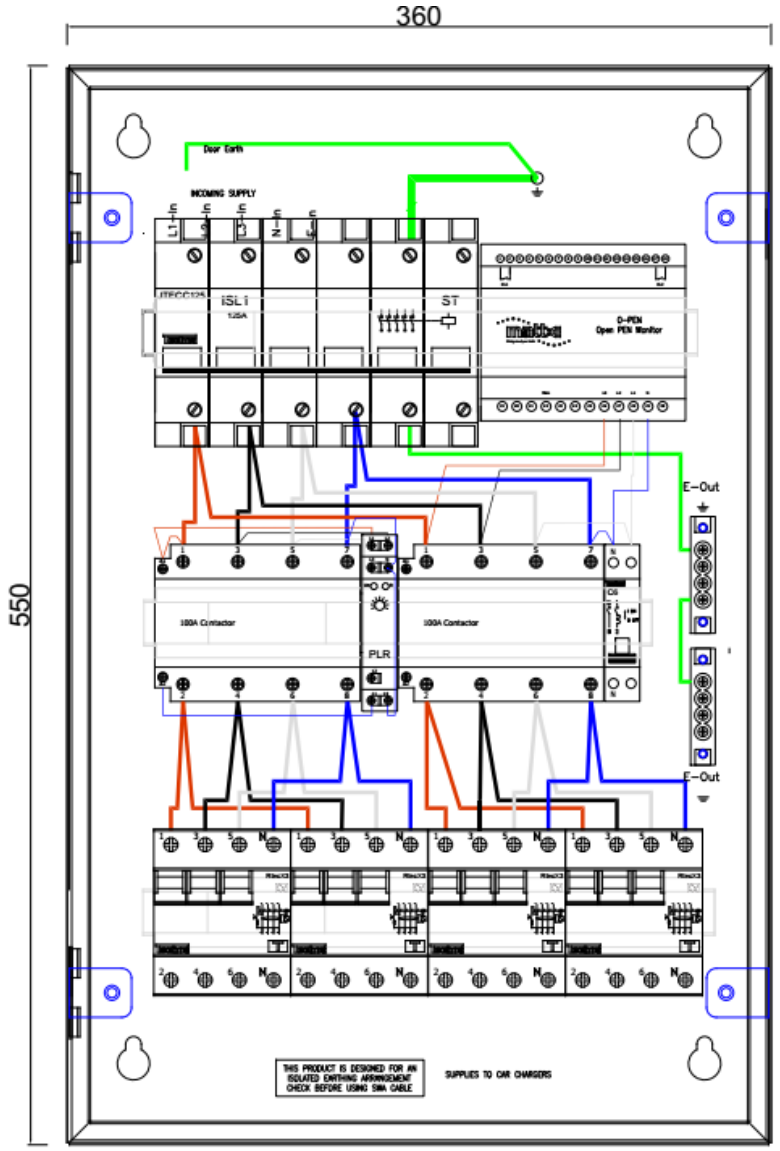


EV-1-63



EV-3-32R


Door Earth
INCOMING SUPPLY
L1-In
L2-In
L3-In
N-In
E-In
ISL1
100A
ST
0-PEN
Open PEN Monitor
E-Out
63A Contactor
63A Contactor
PLR
RTec X3
E-Out


360
550
Door Earth
INCOMING SUPPLY
ISL1
ST
0-PEN
Open PEN Monitor
E-Out
100A Contactor
100A Contactor
PLR
E-Out
E-Out
THIS PRODUCT IS DESIGNED FOR AN ISOLATED EARTHING ARRANGEMENT CHECK BEFORE USING SWA CABLE
SUPPLIES TO CAR CHARGERS

single phase infrastructure

EV connection centres for single phase infrastructures.

SP-EVCP-R

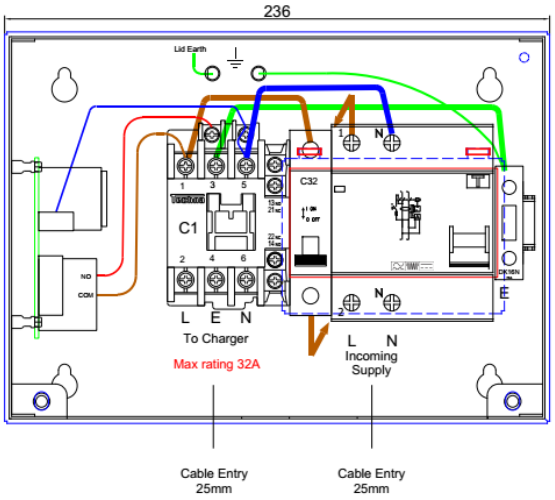
SP-EVCP-B

The single phase protection devices have been designed to replace a garage board to reduce cost and simplify installation.

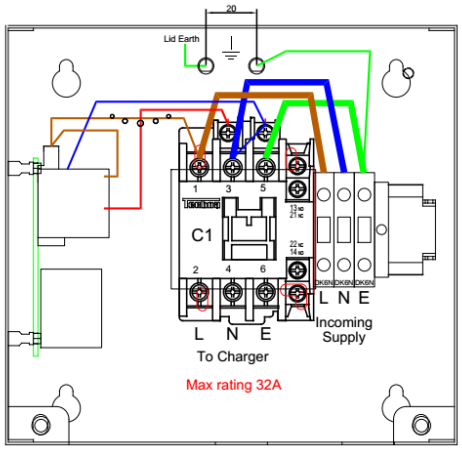
The units are available in multiple configurations to suit all domestic installations. Options available include;

- Double pole MCB
- Type A RCBO
- Type B RCCB
- Current limiting for maximum demand and diversity load curtailment in line with Regulation 722.311.201

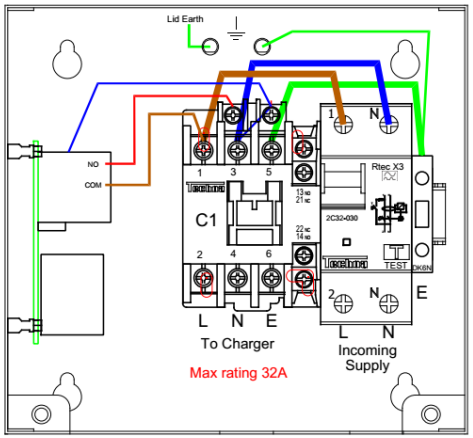
SP-EVCP-B



SP-EVCP-T



SP-EVCP-R



Connection diagrams

The matt:e SP-EVCP electronic device monitors the supply voltage and disconnects the live conductors of the supply and protective earth in accordance with regulation 543.3.3.101 (ii) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms.

This helps prevent the risk of electric shock if dangerous touch voltages occur, fully compliant with BS:7671: 2018 amendment 1: 2020 Regulation 722.411.4.1 (iv)

Key Product Benefits

- Standardises installation
- No more scanning for buried services
- Minimises civil works
- Prevents danger posed by driving Earth electrodes into the ground
- Allows charge points to be mounted directly onto metal clad structures
- Safer earth connection as connected directly onto PME supply
- Guarantees that the earth resistances values met and are maintained all year round
- Designed and manufactured in Great Britain

Simplifying EV connection