
Please note the following corrections

**SUMMARY OF CORRECTIONS**

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<td>1</td>
<td>10</td>
<td>722.411.4.1</td>
<td>NOTE 5 applies equally to (iii), (iv) and (v) and, therefore, should not be indented under (v).</td>
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<td>2</td>
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<td>722.511.101</td>
<td>The text should not be emboldened.</td>
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<td>3</td>
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<td>722.512.2.203</td>
<td>Impact severity AG3 should be high.</td>
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<td>4</td>
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<td>Incorrect Regulation number, 722.411.4 (iii) changed to 722.411.4.1 (iii).</td>
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The corrections are shown in red on the following pages.
Protection for safety

Protection against electric shock

General requirements

The protective measures of obstacles and placing out of reach (Section 417) shall not be used.

The protective measures of non-conducting location (Regulation 418.1) and earth-free local equipotential bonding (Regulation 418.2) shall not be used.

TN system

A PME earthing facility shall not be used as the 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 charging 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.

NOTE 1: Annex 722, item A722.2 gives some information relating to (i).

NOTE 2: See also Regulation 641.5 when undertaking an addition or alteration to an existing installation.

(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.

NOTE 3: Annex 722, item A722.3 gives guidance on determining the maximum resistance required for the earth electrode in (ii).

Protection against 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 than 4 s. The device shall provide isolation and be selected in accordance with Table 537.4. Closing or resetting of 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 included within the charging equipment. See NOTE 5.

NOTE 4: Annex 722, item A722.4 gives guidance on (iii).

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 than 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. See NOTE 5.

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). Equivalent means of functionality could be included within the charging equipment. The device (or means of functionality) shall operate by electrically disconnecting the vehicle from the live conductors of the supply and from protective earth in accordance with Regulation 543.3.3.101(ii). It shall provide isolation and be selected in accordance with Table 537.4. See NOTE 5.

NOTE 5: See Section 511. BS 7671 does not deal with the safety requirements for the construction of electrical equipment. Where equipment to be used is not covered by a British or Harmonized Standard or is to be used outside the scope of its standard, it is the responsibility of the electrical installation designer or other person responsible for specifying the installation to establish that the manufacturer of the equipment has ensured that the equipment satisfies the safety objectives of the relevant Directive(s), or it will not benefit from a presumption of conformity afforded by the appropriate product standard.

Where buried in the ground, a protective conductor connected to an earth electrode for the purposes of (ii) or (iii) shall have a cross-sectional area not less than that stated in Table 54.1.
Protective conductors and exposed-conductive-parts downstream of a protective device provided for the purposes of (iii), (iv) and (v) shall have no connection to:

(a) any protective conductors or exposed-conductive-parts of any circuit not protected by the same protective device; or
(b) any extraneous-conductive-part.

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

722.413 Protective measure: Electrical separation

722.413.1.2 This protective measure shall be limited to the supply of one electric vehicle supplied from one unearthed source. The circuit shall be supplied through a fixed isolating transformer complying with BS EN 61558-2-4.

NOTE: An example of an arrangement for the supply of a Class I electric vehicle charging point from a separated source is shown in Annex A722, Item A722.5.

722.5 Selection and erection of equipment

722.51 Common rules

722.511 Compliance with standards

722.511.1 Where an EV charging point is built into a low voltage switchgear or controlgear assembly the requirements of the relevant part of BS EN 61439 series shall apply.

722.511.101 EV charging equipment shall comply with the appropriate parts of the BS EN 61851 series.

722.512 Operational conditions and external influences

722.512.2 External influences

722.512.2.201 Presence of water (AD)

Where installed outdoors, the equipment shall provide a degree of protection of at least IPX4.

722.512.2.202 Presence of solid foreign bodies (AE)

Where installed outdoors, the equipment shall provide a degree of protection of at least IP4X.

722.512.2.203 Impact (AG)

Equipment installed in public areas and car park sites shall be protected against mechanical damage (impact of medium-high severity AG3). Protection of the equipment shall be afforded by one or more of the following:

- the position or location shall be selected to avoid damage by any reasonably foreseeable impact
- local or general mechanical protection shall be provided
- equipment shall be installed that complies with a minimum degree of protection against external mechanical impact of IK08 in accordance with the requirements of BS EN 62262.

722.53 Protection, isolation, switching, control and monitoring

722.531 Devices for protection against electric shock by automatic disconnection of supply

722.531.3 Residual current devices (RCDs)

722.531.3.1 RCDs shall disconnect all live conductors.

722.531.3.101 Unless supplied by a circuit using the protective measure of electrical separation, each charging point incorporating a socket-outlet or vehicle connector complying with the BS EN 62196 series shall be protected by an RCD having a rated residual operating current not exceeding 30 mA.
ANNEX A722 (Informative)

GUIDANCE FOR TN SYSTEMS WHERE PME CONDITIONS APPLY

A722.1 Neutral current of a three-phase installation

Where the power factors of the currents in all three phases are similar and triple harmonics can be neglected, it may be assumed that the neutral current of a three-phase installation is given by:

\[ I_n = \sqrt{I_{n1}^2 + I_{n2}^2 + I_{n3}^2} - I_{n1}I_{n2} - I_{n1}I_{n3} - I_{n2}I_{n3} \]

NOTE: The maximum neutral current \( I_{n\text{m}} \) occurs under conditions of maximum imbalance, not necessarily maximum overall demand.

A722.2 Load balance

Where triple harmonics can be neglected, condition (i) of Regulation 722.411.4.1 may be assumed to apply where the following condition is met. This formula should take account of \( C_{\text{max}} \) in line with PD CLC/TR 50480.

\[ \frac{I_{\text{n}1}U_{\text{n}1}C_{\text{max}}}{U_{\text{inst}}(U_{\text{n}1}C_{\text{max}} - 70)} \leq 70 \text{ V} \]

A722.3 Earth electrode resistance

For the purposes of condition (ii) of Regulation 722.411.4.1, the sum of the resistances of the earth electrode and the protective conductor connecting it to the main earthing terminal must meet the following condition, as applicable.

For a single-phase installation:

\[ R_{A,\text{ev}} \leq \frac{70 U_{\text{n}1}C_{\text{max}}}{I_{\text{n}1}(U_{\text{n}1}C_{\text{max}} - 70)} \]

For a three-phase installation:

\[ R_{A,\text{ev}} \leq \frac{70 U_{\text{n}1}C_{\text{max}}}{I_{\text{n}1}(U_{\text{n}1}C_{\text{max}} - 70(I_{n1}^2 + I_{n2}^2 + I_{n3}^2))} \]

NOTE 1: The above three-phase formula for \( R_{A,\text{ev}} \) is valid only where \( I_{n\text{m}} > \frac{70(I_{n1}^2 + I_{n2}^2 + I_{n3}^2)}{U_{\text{n}1}C_{\text{max}}} \). Where this is not the case, this indicates that condition (i) of Regulation 722.411.4.1 applies and that an earth electrode is not required for the purposes of condition (ii) of that regulation.

NOTE 2: The above currents and voltage are magnitudes only; they are not phasors.

NOTE 3: In determining \( I_{n\text{m}} \), \( I_{n1} \), \( I_{n2} \) and \( I_{n3} \), allowance must be made for single-phase vehicles being charged from three-phase charging points.

A722.4 Guidance on voltage monitoring device described in Regulation 722.411.4.1 (iii)

Regulation 722.411.4.1 (iii) 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 722.411.4.1 (iii):

(i) the circuit protective conductor and neutral

(ii) the circuit protective conductor and the consumer’s 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 system, provided that suitable precautions are also taken to disconnect the device when the supply to one or more-line conductors is interrupted.

Where used, measurement earth electrodes should be located at a sufficient distance from other earth electrodes and/or other buried exposed-conductive-parts and/or extraneous-conductive-parts connected to the PME earthing terminal to reduce transfer of earth potential rise on the PME system during a PEN failure.
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