

## **EV Charging on the Public Network**

According to Western Power Distribution, PME, known as TN-C-S within BS7671 (Requirements for Electrical Installations, IEE Wiring Regulations) is the most common form of earthing provided at new installations.

During normal operation of a PME (TNCS) system this is a cost effective and safe option for an earthing system into a premise.

Unfortunately there are occasions where the incoming neutral is broken, this is called an open PEN, this effectively can mean that line or phase voltages can appear on the neutral and subsequently be on the PME Earth in the premise at single or dual phase voltages.

This has been a recognised problem for years and fortunately not a lot of instances of this occurring have been reported by the DNOs, with our ageing grid and the transformation of how it is utilised we will unfortunately see more instances of this occurring.

### **Electric Vehicle Charging**

2019 is looking to be a major growth year for Electric Vehicle sales and as such will mean all EV owners will require charge points at home and additionally workplace/public chargers. This is wonderful news for the environment on a global scale with more and more power being generated through renewable sources. The issue throughout Europe and distinctly in the UK is the PME supplies! For years we have banned caravan parks having a PME supply within close proximity of plug in caravans or mobile vehicles due to the metal bodies of the vehicle and the potential voltage that could occur under grid fault conditions, now we decide to allow great big lumps of metal Electric Vehicles to be charged on our driveways!

With the introduction of the 18<sup>th</sup> Edition of the IET Wiring Regulations coming into force on January 1<sup>st</sup> 2019 and the previously released 'COP for Electric Vehicle Charging Equipment Installations' and GN7 (Guidance note 7), we now have a clear picture of what we can and what we cannot do.

### **Regulations**

#### **Directly taken from BS7671 and the COP**

Regulation 722.411.4.1 of BS 7671 imposes requirements for Electric Vehicle charging where they form part of a TNCS System and a PME Earthing facility is used:

5.3.2 Precautions to be taken for PME Supplies from the COP for Electric Vehicle charging

BS7671 does not allow a PME Earthing facility to be used to supply an electric vehicle charging point unless the requirements of Regulation 722.411.4.1 are met. The alternative is

to provide protection against electric shock by measures that do not make use of the PME earth including:

### 5.3.2

(a) using a TT system as 5.3.3

(b) Isolation transformer to separate the earths as 5.3.4

(c) Installing equipment that detects open-circuit voltage as 5.3.5

(d) Electrical separation as 5.3.6

### 5.3.3 Converting to a TT system

There are 2 options:

(a) Make the circuit that supplies the charging equipment part of a TT system

***This requires a risk assessment*** ensuring prevention of simultaneous contact between those exposed conductive parts or extraneous conductive parts connected to the TT System and PME System.

(b) Convert the whole installation to a TT earthing system

Note: These options should not be adopted where there would be simultaneous access to conductive parts of an adjacent installation connected to a PME Supply

**When assessing whether to adopt TT in an existing installation, consideration must also be given to the safety of installing earth electrodes and the risk of striking underground services. For some installations it may not be possible to provide suitable earth electrodes safely, without disruptive excavation.**

***When all the above points are considered, converting part or all of some installations to TT may not be practicable.***

### 5.3.4 Installing an isolating transformer

This avoids any problems associated with an open circuit fault in the neutral (PEN ) conductor as the isolating transformer electrically separates the PME supply earth from the charging equipment.

### 5.3.5 Installing equipment that detects open-circuit voltage

This equipment is currently not available but will still need a reference to Earth (**mother Earth**) via an earth rod if and when it is developed as per Guidance Note 7

### 5.3.6 Electrical Separation

Where electrical separation is used (isolating transformer) to provide protection against electric shock all of the requirements of section 413 shall be met.

## Western Power Distributions Network

Western Power Distribution have released a Company Directive, Standard Technique: SD5G (PART 1) Relating to the connection of Electric Vehicles charging with a capacity of equal to or less than 32amps per phase released September 2018.

6.3 TT earthing arrangements shall be utilised by electric vehicle charging pillars that do not meet the PME requirements specified in clause 6.1

The customers buried TT earthing system (*water pipes, gas pipes etc*) shall be segregated from any WPD buried earthing system (including buried LV metalwork and cabling) by the required distance detailed in Table 1:

Connection	Single phase or Unbalanced 3 Phase Connection	Balanced Three Phase Connection
<b>Minimum Segregation</b>	<b>3.6M</b>	<b>0.3M</b>

The electric vehicle charge point (whole installation) shall be segregated (above ground) from metalwork connected to PME or SNE earthing systems nu at least 2.5m, eg. Metallic street lights and steel framed buildings.

## Conclusions

The Regulations and DNOs make it quite clear that installing an earth rod into the network is virtually impractical and, in some cases impossible, for example semi-detached houses, town houses and the like due to the '*sphere of influence*' of the properties PME Connected services and indeed that of adjoining properties PME systems, this leaves the installer/designer with two choices,

1. voltage sensing device (**that still requires an earth rod**) so effectively has the same problems as a TT System
2. Fit an Isolating transformer whereby all Regulations are adhered to