ECA Excellence in Electrotechnical & Engineering Services

AMD2 BS 7671:2018+A2:2022

TECHNICAL BULLETIN

Installing an additional earth electrode in TN earthing systems

BS 7671:2018+A2:2022 (the Wiring Regulations) recommends that an additional connection to Earth, by means of an earth electrode to the main earthing terminal is installed.

Key Information:

If a designer wishes to install an additional connection to earth, i.e. installing an earth electrode and connecting to the main earthing terminal of the installation, there are several considerations that need to be designed and accounted for:

- Type of the additional earth electrode
- Location of the additional earth electrode
- Avoiding underground services
- Resistance of the additional earth electrode
- Facilitation of maintenance, inspection & testing of the earth electrode

The Regulation

Regulation 411.4.2 of the Wiring Regulations states that the neutral point or the midpoint of the power supply system shall be earthed. If a neutral point or midpoint is not available or not accessible, a line conductor shall be earthed.

Exposed-conductive-parts of the installation shall be connected by a protective conductor to the main earthing terminal of the installation, which shall be connected to the earthed point of the power supply system.

It is recommended that an additional connection to Earth, by means of an earth electrode in accordance with Chapter 54, is made to the main earthing terminal. This recommendation does not apply to outbuildings of dwellings served by the installation

This is not mandated and is a recommendation only, and in most installations may not be practicable, such as existing installations, terraced town housing and high-rise residential buildings.

Choosing a suitable additional earth electrode

Regulation 542.2.2 of the Wiring Regulations lists suitable earth electrodes that shall be used.

The following types of earth electrode are recognized for the purposes of the Regulations:

(i) Earth rods or pipes
(ii) Earth tapes or wires
(iii) Earth plates
(iv) Underground structural metalwork embedded in foundations or other metalwork installed in the foundations
(iv) Welded metal reinforcement of concrete (except pre-stressed concrete) embedded in the ground
(v) Lead sheaths and other metal coverings of cables, where not precluded by Regulation 542.2.5
(vi) Other suitable underground metalwork.

NOTE: Further information on earth electrodes can be found in BS 7430.

Location of an additional earth electrode

The location of the additional earth electrode requires very careful consideration and will depend on a number of factors, which the designer, and possibly the installer, will need to take into account when siting the electrode(s), such as, as required by Regulation 542.2.1.

Examples of issues likely to occur for most, if not all, electrode installations are:

(a) damage – account to be taken of all potential causes of damage to which the earth electrode and earthing conductor could be subjected. Such causes may include, for example, theft, vandalism, gardening, farm equipment, livestock animals, or future excavation associated with a building extension, and will depend to a large extent on the particular circumstances of the location.
(b) corrosion – compatibility with the soil: copper is generally considered to be one of the better and more commonly used materials for earth electrodes. However, the corrosive effects of dissolved salts, organic acids and acid soils should be considered.
(c) corrosion – galvanic effects: this may occur where items of dissimilar buried metalwork are electrically connected together. This electrolytic corrosion can have adverse effects on earth electrodes and earthing conductors, as well as other underground services and structural metalwork.

Where foundation earth electrodes are installed, the materials and dimensions of the earth electrodes shall be selected to withstand corrosion and to have adequate mechanical strength.

Avoiding underground services

Installers should take care in commissioning, planning, managing and carrying out work on or near underground services and be aware of the potential dangers of working near underground services and take steps to reduce any direct risks to people's health and safety, as well as the indirect risks arising through damage to services.

The three basic elements of a safe system of work during excavation:

- Planning the work
- Locating and identifying buried services
- Safe excavation

Installers should undertake surveys to reduce the risk and potential damages of working near underground services, examples may include a mixture of:

- CAT & Genny Cable Avoidance in line with guidance from HSG 47
- Identify and read gas/electricity/water/telecom service plans
- Avoiding proximity to other services and DNO electrodes
- Utility surveys – usually free from utility companies
- Specialist ground surveys & utility mapping such as ground-penetrating radar

HSE issue guidance on “Excavation and underground services” and publications such as “Avoiding danger from underground services” – HSG 47 (ISBN 978 0 7176 6584 6) is downloadable for free from the HSE website.

Consideration to appoint a specialist earthing contractor, such as a Lightning Protection specialist or Steeplejack may be beneficial.

Resistance of the additional earth electrode

The electrical installation designer should determine the maximum acceptable resistance of the electrode as this may influence the type of electrode selected and/or its location.

In the case of rods and plates, in circumstances in which it may be necessary to achieve a low resistance, a number of rods or plates etc. can be connected in parallel. Dimensions and depths of the electrode, together with the resistivity of the soil, will greatly influence the resistance to Earth

BS 7671 does not give examples of typical values (R_A) to achieve for an additional earth electrode installed in a TN system.

Whereas there is no specific value given in BS 7671, in other guidance, such as BS 7340:2011+A1:2015 (the guidance specific for earthing) the value of 20 Ω is deemed as sufficient (8.5.2.3).

Facilitation of maintenance, inspection & testing of the additional earth electrode

The additional earth electrode will need to be maintained and tested; therefore, a means should be provided to facilitate the disconnection of the additional earthing conductor in order to measure the external earth fault loop impedance. This should be located in an accessible position. The means of disconnection may be in the form of a removable link combined with the MET or bar, or it may be a joint capable of disconnection only by means of a tool (e.g. a spanner or screwdriver).

The connection of an earthing conductor to an earth electrode is required to be accompanied with a warning notice with the words 'Safety Electrical Connection – Do Not Remove' adjacent to the conductor. The label should be durable and securely fixed in a visible position at or near the connection.

As the additional earth electrode is now part of the electrical installation, it shall not be discarded and should form part of the periodic inspection process for the entire installation and have its condition and measurements recorded and documented appropriated.

Summary

- Installing an additional earth electrode is only a recommendation and is not mandatory.
- Guidance from Guidance Note 8 and the requirements from the Earthing Standard BS 7430 should be considered.
- The design used for and the construction & installation of an earth electrode requires very careful consideration.
- The use of a specialist contractor to install an additional earth electrode, such as a Lightning Protection specialist or Steeplejack.
- Periodic maintenance, inspection & testing needs to be carried out of the additional earth electrode as part of the electrical installation.

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