

Types of earthing systems



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Introduction

Purpose of earthing in an electric power system is to limit, with respect to the general mass of earth, the potential of current carrying conductors, which are part of the equipment, and non- current carrying metal works, associated with the equipment, apparatus and appliances connected to the system.

Type of Earthing Systems

There are four main type of earthing systems. These include:

TN systems

Point directly to ground, the exposed conductive parts connected to this point the installation of the protection of conductors. Two types of TN system are approved for new installations in South Africa. These are defined according to the arrangement of neutral and protective conductors, as follows:

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TN-S system: in which throughout the system, a separate protective conductor is used;

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TN-C-S system: in which the neutral and protective functions combined in a single command chain of system.

TT system

Which one point is directly earthed, the exposed-conductive-parts of the installation being connected to earth electrodes electrically independent of

the earth electrodes of the power system. The TT system is not permitted for new installations in South Africa, but still exists in many of the older areas.

IT system

Which has all live parts isolated from earth, or one point connected to earth through an impedance, the exposed-conductive-parts of the electrical installation being earthed independently or collectively or to the earthing of the system. The IT system is not used for the public distribution of electricity, but is used in private installations, mainly for reasons of continuity of service. Three phases IT systems with a distributed neutral can in certain circumstances result in hazardous conditions. This latter type of IT system is to be deprecated.

The problems of voltage variations between phase and neutral that can result from a break in the neutral, are common to all types of low voltage distribution systems. The increasing usage of the TN-C-S system has however introduced a further dimension to the consequences of a loss of the neutral conductor.

TN-C-S system

Mainly for economic reasons, across the globe, the TN-C-S power system is becoming more and more widely used for the distribution of low voltage electrical power. The concept of combining the neutral and protective functions in a single conductor immediately resulted in the elimination of one of the five distributed conductors that are required for a three phase TN-S system (three phases, one neutral and one protective conductor).

In a TN-C-S system, the separate protective conductor (PE) for each consumer, is created by simply tapping off a second parallel conductor from the PEN conductor at a location that is close to or at the point of supply to individual consumers. The parallel conductor in the installation then becomes the neutral conductor.

The main disadvantage of the TN-C-S distribution system is this unprotected hazardous condition that could arise in the event of a break in the PEN conductor. This hazard continues to exist independent of the presence of any protection devices that may be installed. In the event of a break in the PEN conductor, all exposed conductive parts will remain “ live” irrespective of the operating state of the main switching or isolating device – whether it is ON (closed) or OFF (open).

Current practice of bonding in HK

Types of low voltage system as defined by the IEC and IEE are identified by the connections to earth of the source (system earth) and the exposed conductive parts of the electrical installation (equipment earth). If these earth terminals are not bonded together by a metallic conductor the system is classified as TT, and the path for earth fault currents is then through the actual earth or ground,.

If the terminals are bonded together with a reliable and low impedance metallic connection the return path will not be through the earth and the system is classified as TN-S.

The terms on which the CLP Power Hong Kong Ltd. and the Hong Kong Electric Co., Ltd. will supply electricity are subject to the Electricity Supply

Ordinance, and the regulations and conditions laid down in the common set of Supply Rules published by both companies. By virtue of his application for electricity supply or his obtaining electricity from the Company, a consumer is bound by and shall abide by the Supply Rules and other terms and conditions.

Supply Rule 407. 1 requires that for every electrical installation the consumer must provide his own earth electrode system by which the exposed conductive parts of his installation are connected to earth. That is, all exposed conductive parts of the installation shall be connected by protective conductors to the main earthing terminal of the installation and that terminal shall be connected to earth electrode(s) via an earthing conductor. This means that every installation is connected to be part of a TT system.

Rule 407. 3. f. (iii) further states that where the supply is taken direct from the Company's transformer or via underground cable, the Company may allow the consumer to provide a bonding conductor between his main earthing terminal and the Company's transformer earth or metallic sheaths of the service cable. Therefore, the installation will be operated as part of a TN-S system. However, this rule also states that in the measurement of the earth fault loop impedance or testing the operation of protective devices, the said bonding conductor must be disconnected, i. e. the design and commissioning of the installation must assume a TT system.