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A Systems Approach to Reliable Earthing Design

Presented at ERA's Earthing 2000 conference,
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European Copper Institute's Stefan Fassbinder (picture) proposed a systems approach to earthing at ERA's Earthing 2000 international conference, organised in Solihull, near Birmingham, UK, on June 21-22.

The original purpose of the earthing system was to provide a low impedance path for the fault currents that occur frequently in all parts of the transmission and distribution network, as well as on user premises. However, today's electromagnetic environment is much more complex and earthing systems must now take into account:

- 'Merging' of the worlds of electrical and electronic engineering
- Increasing train traffic
- Large scale undergrounding since 1980's
- Interference with water & gas distribution systems
- Electromagnetic waves resulting from radar & broadcasting stations

These developments all cause increased standing currents that result in two problems: electrical noise voltage on the earth connection is increased, and corrosion of buried metalwork is accelerated.

Many electronic devices, such as IT equipment, require a noise free connection to the earthing system but also pass a small leakage current into it. The 'protective conductor' must therefore provide a functional earth to the equipment operating on the system - that is, it has to provide a path for the leakage currents (at the fundamental frequency) and the high frequency noise currents arising from, for example, switched mode power supplies via RFI filters.

As 2 recent case studies in Germany demonstrate, problems can occur with earthing electrodes in the presence of leakage currents after 10 years, well within the buildings lifetime:

- At the airport of Paderborn - Lippstadt, earthing electrodes were removed from the earth in a rewiring of the electrical system. This showed heavy corrosion of electrodes after 10 years in the ground.
- A lightning strike of a computer centre showed high damages, despite a recent check of the earthing & lightning protection system. The earthing system happened to be inspected just before the event. A post-mortem analysis showed very rapid deterioration of the earthing system, due to corrosion from leakage currents.

A systems approach to earthing requires a low impedance path to earth over a wide range of frequencies. Earthing electrodes need to be selected and installed with care to ensure long

corrosion free service. It is much cheaper to install an integrated earthing system when the building is first erected than to retrofit a less satisfactory ad-hoc 'fix' to an inadequate system.

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