Earthing Systems – 1

Supply systems require a safety electrical earthing facility. The manner in which this is effected will depend on whether the supply is overhead or underground and the conductive property of the ground surrounding the installation. Systems are classified in accordance with a letter coding:

First letter – type of earthing:

T – at least one point of the supply is directly earthed.

I – the supply is not directly earthed, but connected to earth through a current limiting impedance. Not acceptable for public supplies in the UK.

Second letter – installation earthing arrangement:

T – all exposed conductive metalwork is directly earthed.

N – all exposed conductive metalwork is connected to an earth provided by the supply company.

Third and fourth letters – earth conductor arrangement:

S – earth and neutral conductors separate.

C – earth and neutral conductors combined.

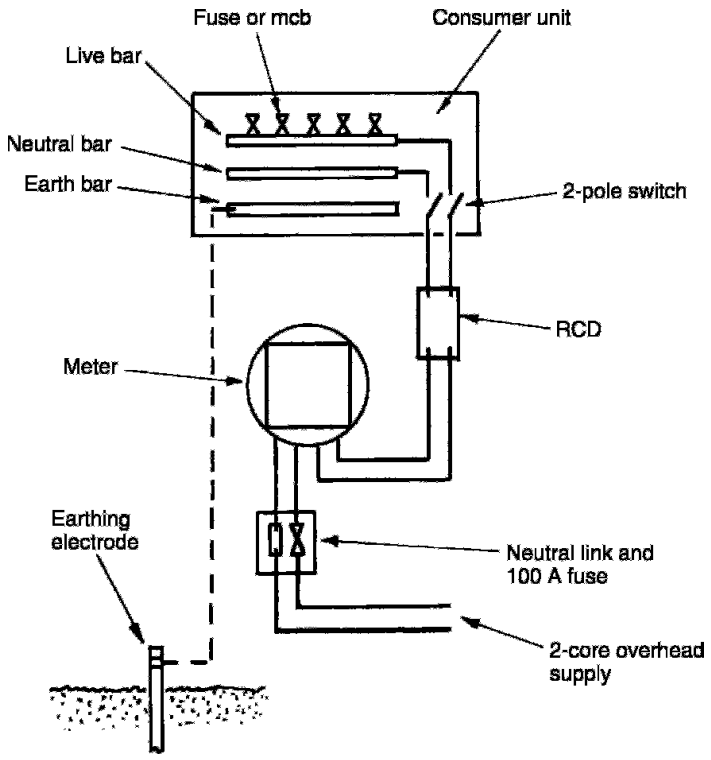
Common supply and earthing arrangements are:

TT (shown below).

TN-S and TN-C-S (shown next page).

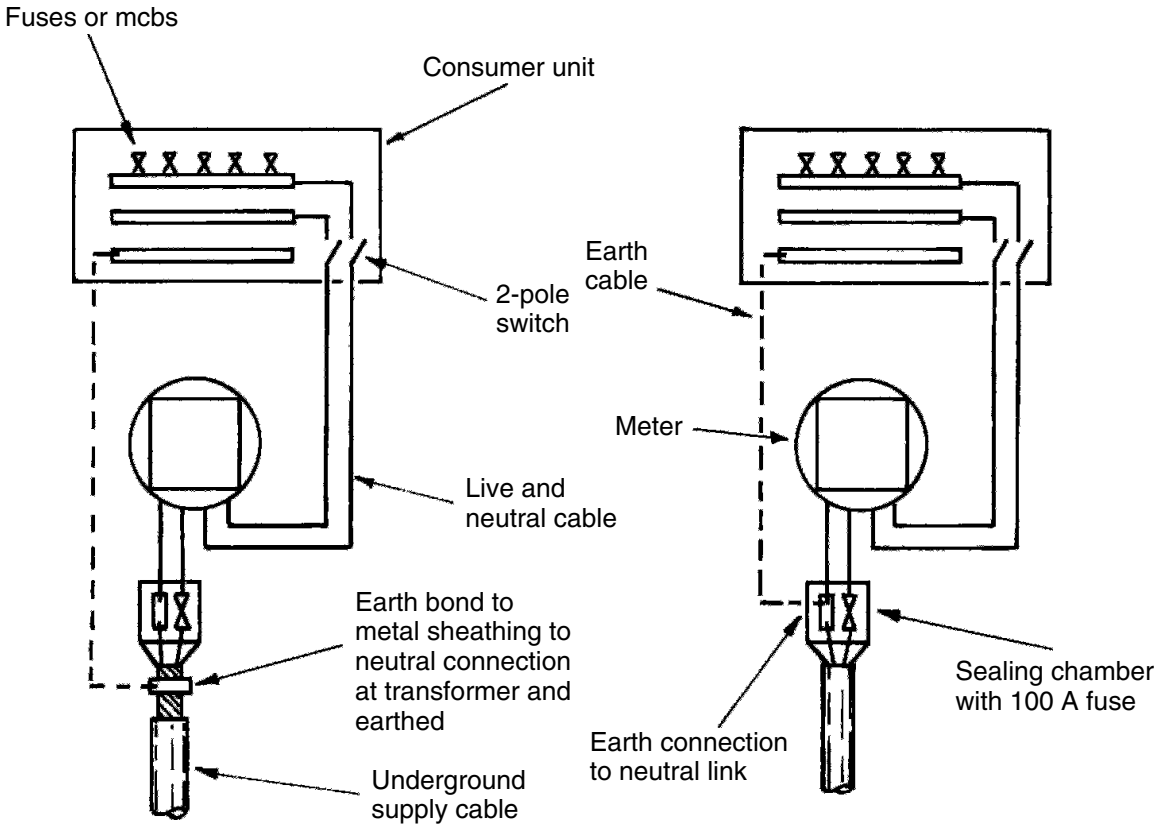
TT system:

Most used in rural areas where the supply is overhead. An earth terminal and electrode is provided on site by the consumer. As an extra safety feature, a residual current device (RCD), generally known as a trip switch, is located between the meter and consumer unit. The RCD in this situation should be of the time delayed type – see page 398.



TN-S system – this is widely used in the UK, with the electricity supply company providing an earth terminal with the intake cable. This is usually the metal sheathing around the cable, otherwise known as the supply protective conductor. It connects back to the star point at the area transformer, where it is effectively earthed.

TN-C-S system – this is as the TN-S system, but a common conductor is used for neutral and earth supply. The supply is therefore TN-C, but with a separated neutral and earth in the consumer's installation it becomes TN-C-S. This system is also known as protective multiple earth (PME). The advantage is that a fault to earth is also a fault to neutral, which creates a high fault current. This will operate the overload protection (fuse or circuit breaker) rapidly.



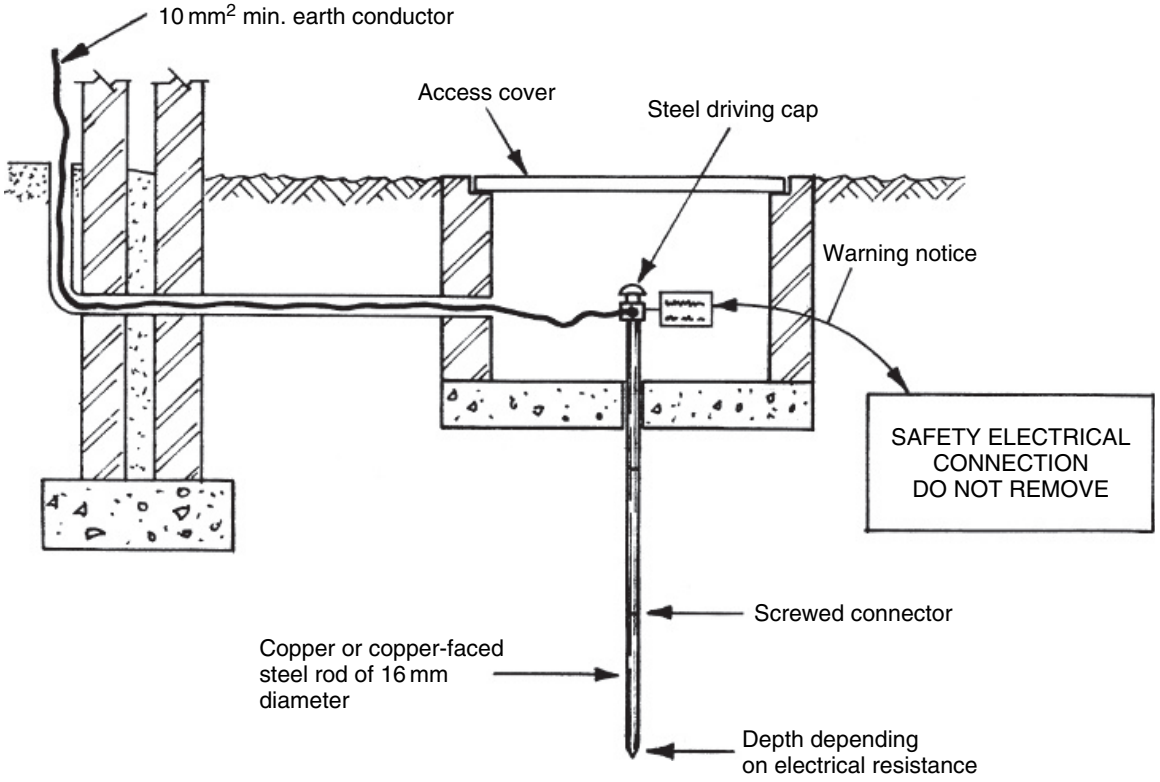
TN-S system

TN-C-S system

Note: Specification of installation cable between supply company's sealing chamber and consumer's unit – phase/live and neutral 25 mm^2, earth 10 mm^2 cross-sectional area.

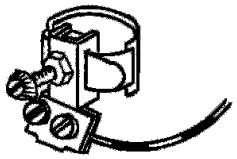
Pages 380, 381 and 385 show that the consumer's earth conductor is connected to the neutral and earthed at the local transformer. For below ground supplies this arrangement provides a path of low resistance for an electrical fault. With an overhead supply typical of rural areas, individual consumers must provide a suitable earth terminal or electrode as shown on page 384.

Unless wet, the ground surface is not usually a very good conductor, therefore ground contact is made at about 1·5 to 2 m below the surface. In the past this was achieved by earth bonding to metal water and gas mains. Since the introduction of plastic pipe materials, this is of course no longer acceptable. Current practices include burying a metal plate or a metal tape mesh arranged over several square metres, or driving a metal rod electrode into the ground. The latter is normally adequate for domestic and other small-scale installations. In some instances, the electrode is housed as shown below. Whatever earth method used, a low resistance to an electrical fault is essential. The IEE Wiring Regulations recommend that the earth electrode resistance should not exceed 200 ohms.

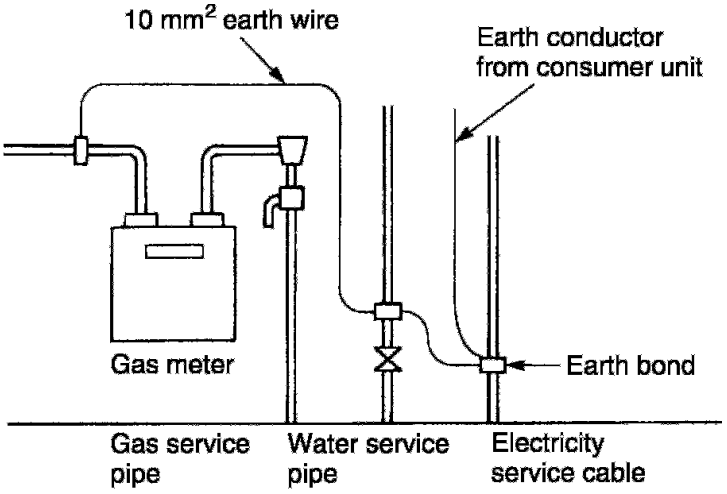


Installation of a housed earth electrode

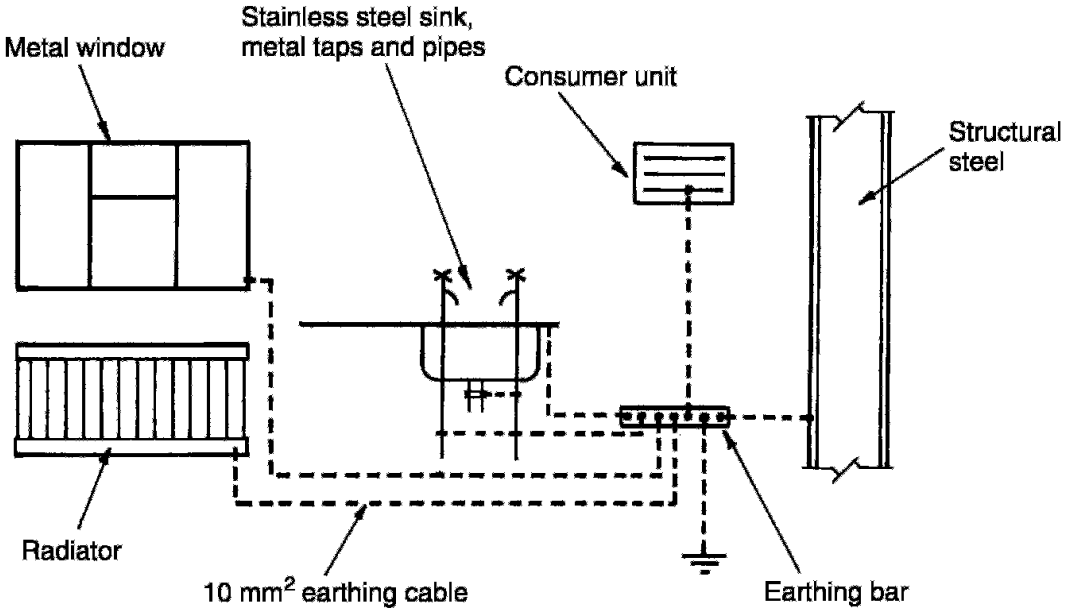
The Institution of Electrical Engineers (IEE) Wiring Regulations require the metal sheaths and armour of all cables operating at low and medium voltage to be cross-bonded to ensure the same potential as the electrical installation. This includes all metal trunking and ducts for the conveyance and support of electrical services and any other bare earth continuity conductors and metalwork used in conjunction with electrical appliances. The bonding of the services shall be as close as possible to the point of entry of the services into a building. Other fixed metalwork shall be supplementary earth bonded.



Earthing clamp for pipes



Bonding of services at intake



Supplementary bonding of extraneous metalwork