Equipotential bonding

BS 7671 defines ‘equipotential bonding’ as:

> **Electrical connection maintaining various exposed conductive parts and extraneous conductive parts at substantially the same potential.**

When used (as it usually is) for the purpose of safety, it is referred to as **‘protective equipotential bonding’**, which is defined as **‘equipotential bonding for the purpose of safety’**.

BS 7671 further defines ‘exposed conductive parts’ as:

> **Conductive part of equipment which can be touched, and which is not normally live, but which can become live under fault conditions.**

This includes:

- steel conduit
- steel trunking
- steel tray
- steel enclosures of wiring systems
- metal accessories
- metallic equipment.

BS 7671 defines ‘extraneous conductive parts’ as:

> **A conductive part liable to introduce a potential, generally earth potential, and not forming part of the electrical installation.**

This will include:

- metallic service pipes (gas, oil, water)
- steel duct work
- structural steel.

If all conductive parts within an installation are electrically connected together then they will be at the same electrical potential. If two separate parts that are at the same potential are touched simultaneously then the potential difference between them will be 0 volts and no current will flow. This will apply even if the parts are at, say, 230 volts as a result of a fault.

Since the supply system is earthed, generally at the star point of the supply transformer, when a fault to the equipotential bonding occurs and its potential rises, then current will flow to earth and this current will cause the protective device(s) to operate and disconnect the supply.

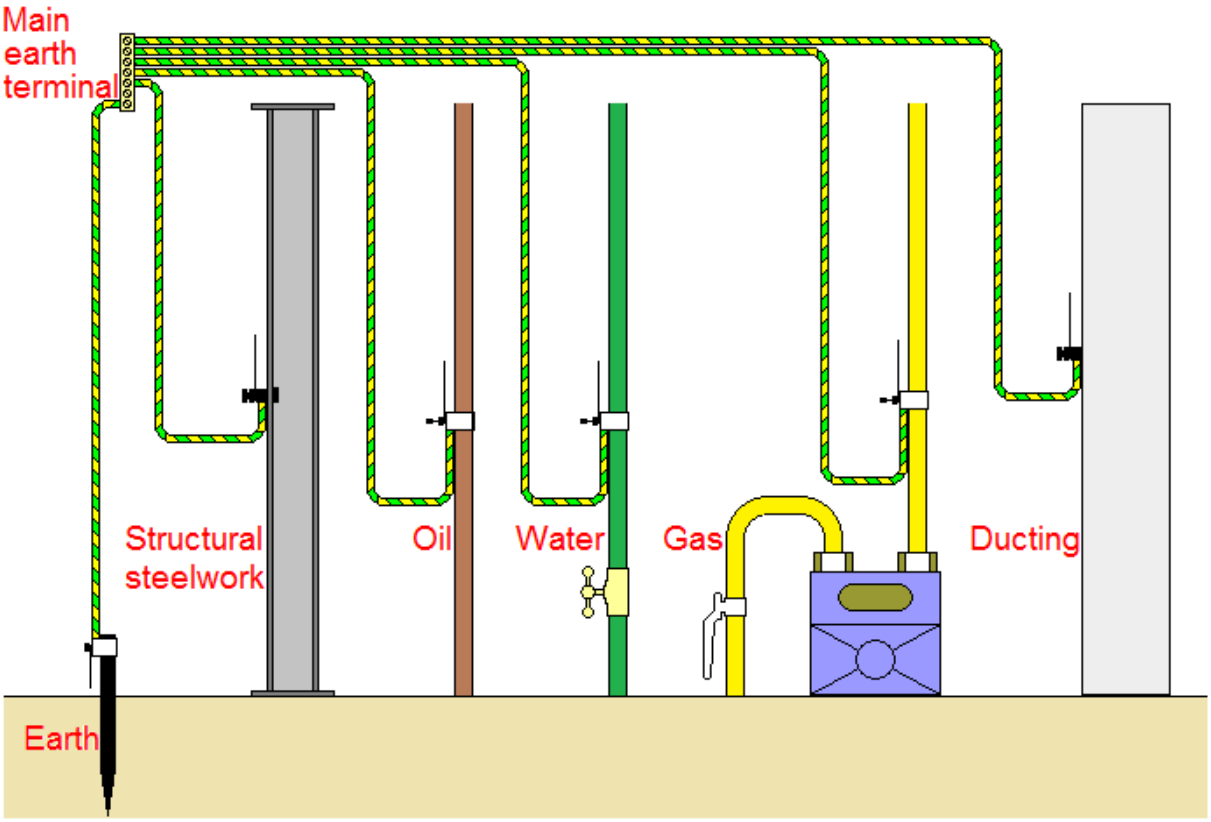
These are the principles of equipotential bonding and protective equipotential bonding.

Main protective bonding

BS 7671 Regulation 411.3.1.2 states that, in each installation main protective bonding conductors complying with Chapter 54 shall connect to the main earthing terminal extraneous-conductive-parts, including the following:

(i) water installation pipes
(ii) gas installation pipes
(iii) other installation pipework and ducting
(iv) central heating and air conditioning systems
(v) exposed metallic structural parts of the building.

The diagram below shows how this is applied:



Supplementary equipotential bonding

The IET **ONSite Guide** (Section 4.6, page 46) states that: 'The purpose of supplementary equipotential bonding is to reduce the voltage between the various exposed conductive parts and extraneous conductive parts of a location during a fault to earth.'

If the required disconnection time cannot be achieved, supplementary bonding shall be applied (Regulation **411.3.2.6**) in accordance with Regulation **415.2**.

The sizing of supplementary bonding conductors is dealt with in Regulation **544.2 (1-5**). **Table 4.6** of the IET **On-Site Guide** gives clearer guidance on this.

There are many myths relating to where and when supplementary equipotential bonding should be used and **Section 4.7 (page 46)** of the IET **ON-Site Guide** dispels some of these myths and is reproduced in full below.

Supplementary equipotential bonding is required in some of the locations and installations falling within the scope of **Part 7** of BS 7671.

If the installation meets the requirements for BS7671: 2008 Including Amendment No 3: 2015 for earthing and bonding, there is no specific requirement for supplementary equipotential bonding of:

- kitchen pipes, sinks or draining boards
- metallic boiler pipework
- metal furniture in kitchens
- metallic pipes to wash hand basins and WCs
- locations containing a bath or shower, providing the requirements of **701.415.2** are met.

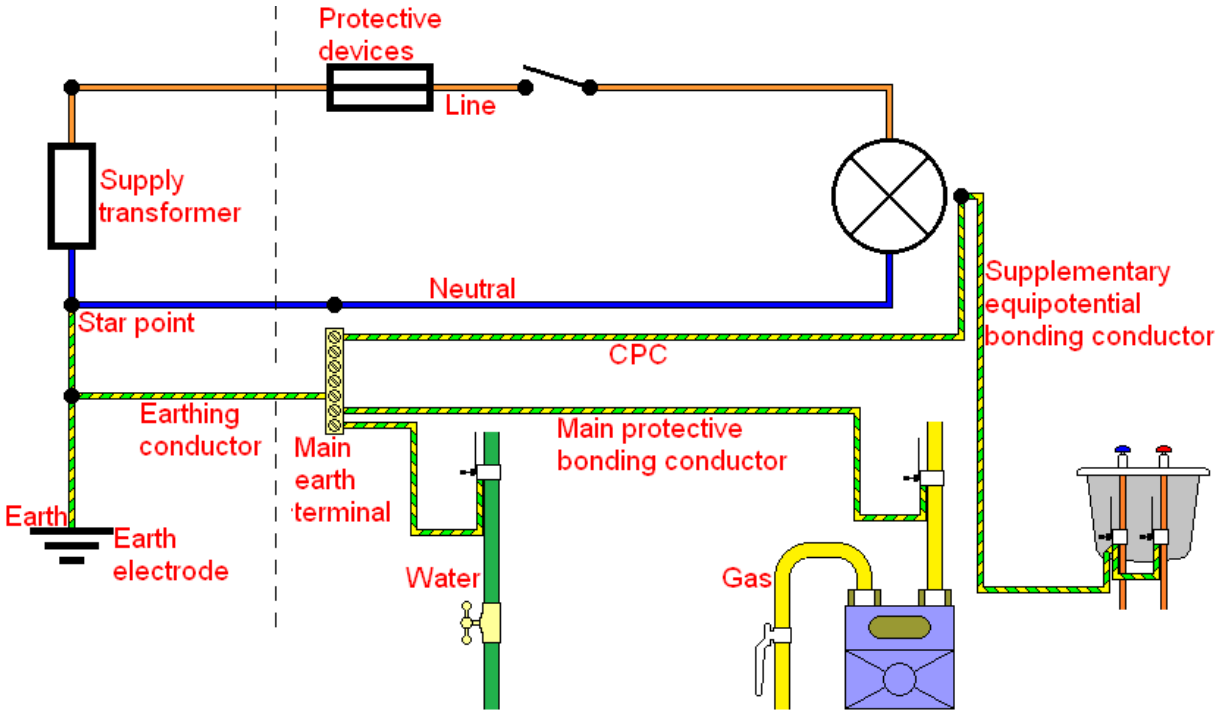
Note: Metallic waste pipes deemed to be extraneous conductive parts must be connected by main protective bonding conductors to the main earthing terminal; see also 4.3 (page 43).

Automatic disconnection of supply (ADS)

With all the main and supplementary bonding in place, in the event of a fault to earth occurring, current will flow to earth and bring about a rapid disconnection of the supply from the faulty circuit by operation of the protective device. This could be a fuse, circuit breaker or RCD.

Important component parts relating to the automatic disconnection of supply to be remembered include:

- CPC
- main protective bonding conductor
- supplementary equipotential bonding conductor
- earthing conductor
- protective devices
- earth electrode.



For further information refer to **Section 4** (Earthing and Bonding) of the IET On-Site Guide (page 43).