AUTOMATIC DISCONNECTION OF SUPPLY, AND HOW A SHOCK HAPPENS

HOW MUCH CURRENT FLOWS THROUGH WET HANDS?

AUTOMATIC DISCONNECTION OF SUPPLY (ADS)

An electric shock from equipment happens when an **exposed conductive part becomes live** because of a fault. For example, a pan of water boils over into an oven and makes a connection between line and the metal case.

Four recognised protective measures against electric shock

1. **Automatic disconnection of supply (ADS)**: used almost universally in the UK.
2. **Double or reinforced insulation** (Class II equipment): two layers of insulation, or one layer of reinforced insulation, so the outer casing can't become live.
3. **Extra-low voltage (SELV and PELV)**: for example SELV, supplied from a separated extra-low voltage (safety isolating) transformer.
4. **Electrical separation**: supply from a separating transformer, like a shaver socket.

ADS is often used **alongside** one of the others. For example, a Class II light can still be on a circuit that uses ADS.

BS 7671 · Chapter 41 · protective measures generally permitted

ADS **only works** when the exposed conductive part is connected to the **MET** by a CPC, and the MET is connected back to the **star point**. You **can't have ADS** without that physical path. The circuit breakers, fuses and RCDs in the consumer unit need a path of **low impedance**. A low impedance means a **high fault current**, and a high fault current trips the device quickly.

```
OUR EXAMPLE: FAULT CURRENT

Earth fault loop path = 1 Ω,  voltage = 230 V
I = V ÷ R = 230 ÷ 1 = 230 A of fault current
→ any circuit breaker or fuse in the consumer unit trips = ADS
(An RCD or RCBO works slightly differently, but it still needs an earth fault
```

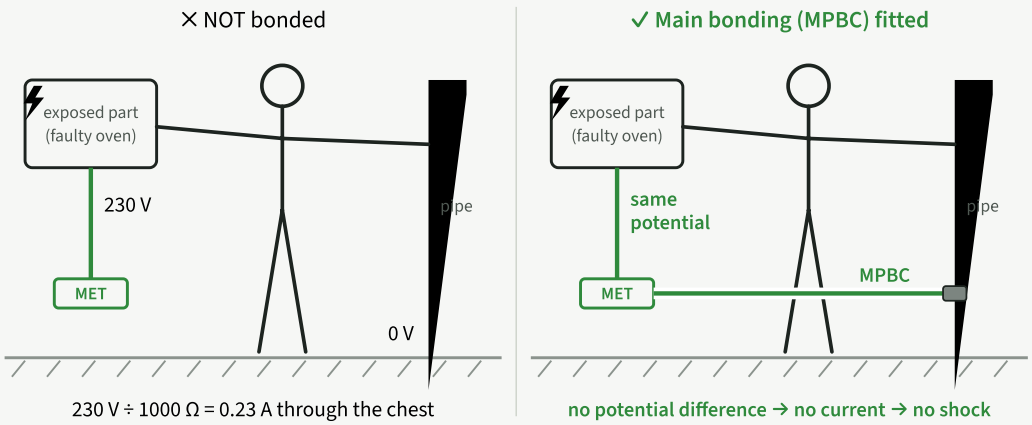
While the fault is there, the equipment is **live until the device disconnects**. That might be as quick as 0.1 s, or as long as 5 s. Different circuits have

different **maximum disconnection times**, which is the subject of another masterclass.

HOW THE SHOCK HAPPENS

During that short window, imagine someone is touching the **live exposed part** with one hand and a **metal pipe** with the other. The pipe goes into the ground, so it's at **earth potential (0 V)**. You can prove that: stand barefoot on your lawn and you're touching earth, but you feel nothing, because the ground is at 0 V.

The exposed part is at **230 V** and the pipe is at **0 V**, so there's a **230 V potential difference**. The person bridges the gap. Current flows through their arms, **across the chest and heart**, and into earth through the extraneous conductive part.



Left: the person is the only path between 230 V and 0 V. Right: a main protective bonding conductor puts the pipe at the same potential as everything connected to the MET, so there's no potential difference across the person.

DRY HANDS

```
Average body resistance ≈ 1000 Ω
I = V ÷ R = 230 ÷ 1000 = 0.23 A
→ more than enough to send the heart
  fibrillation (cardiac arrest)
```

WET HANDS

```
Body resistance lower, say 500 Ω
I = V ÷ R = 230 ÷ 500 = 0.46 A
→ double the current. A child's resi
  is lower still (thinner skin, smal
```

A handy shorthand

People often say "voltage moves" or "voltage flows". Strictly, **voltage** is the potential difference that **drives current**, and it's the **current** through the body that does the harm. This chain is worth learning: **no potential difference → no current → no electric shock.**

Free section from Sparky Study Notes. The full Level 3 notes, 1,463 practice questions and the video lessons: sparkystudynotes.co.uk