OPEN PEN: WHY OVER-BONDING IS DANGEROUS

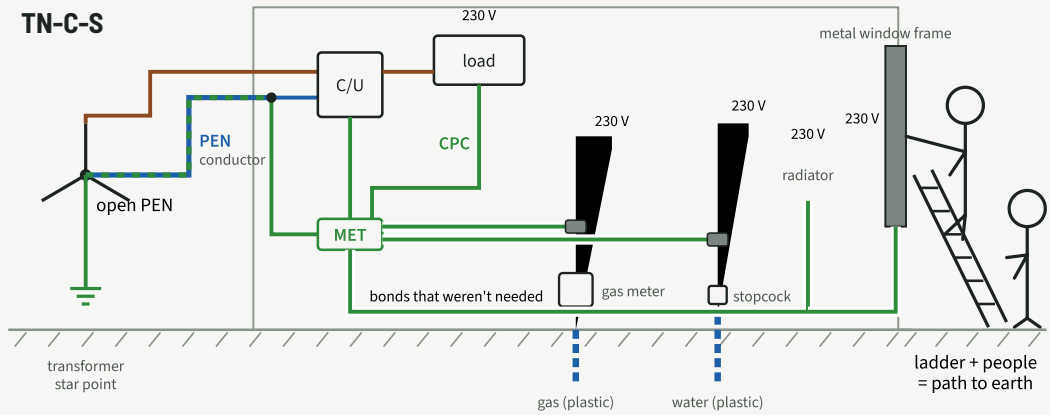
WHY CAN OVER-BONDING BE DANGEROUS?

Now change the drawing to **TN-C-S**, the most common system in the UK, where the supply cable's **PEN conductor** does the job of both neutral and earth. Both the gas and water supplies come in as **plastic**, and the pipework inside is metal. So **no bonding is needed**, but someone bonds the pipes anyway, "just in case".

Normal operation: current goes from the star point, through the consumer unit to the load, back along the neutral and down the PEN to the star point. Everything works.

Open PEN fault: the PEN conductor breaks, somewhere on the supply side, outside the installation. It's **out of our control** and can't be prevented, only its effects. Open PENs can only happen on **TN-C-S**.

- The load current has no way back through the neutral. The equipment probably stops working.
- The current finds its way into the **MET** instead, so every exposed conductive part (connected by CPCs) becomes **live to touch at up to 230 V**.
- Anything that was **bonded when it didn't need to be** is **live too**: taps, pipes, radiators and metal window frames.



Over-bonding on TN-C-S. The open PEN puts the MET and everything bonded to it up to 230 V. Indoors, nobody touching earth feels anything. But a window cleaner on an aluminium ladder (and the person footing it) are a **path to earth**.

Indoors, you probably wouldn't feel it, because you're not in contact with earth (like the knife rack). But imagine the aluminium window frame is being cleaned by someone on an **aluminium ladder**, with someone footing it on the ground.

The ladder is effectively an **earth electrode**. Both people could be electrocuted, and the one at the top could fall.

> **Don't bond what doesn't need to be bonded**If the pipes, radiators and window frame hadn't been bonded, only the exposed conductive parts would go live in an open PEN fault. The taps, radiators and frames would have **no connection to the MET**. "Belt and braces" bonding comes from a lack of knowledge. It isn't extra safety.

Please don't test the idea that you can hold a live conductor safely if you're not in contact with earth.

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