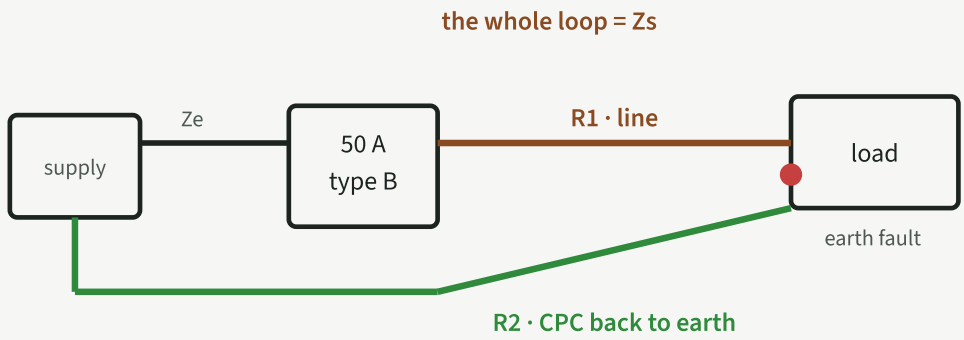
EARTH FAULT LOOP IMPEDANCE

WHAT IS ZS, AND WHY DOES IT MATTER?

For ADS to work, enough fault current has to flow to trip the device **within** that disconnection time. What limits the fault current is the impedance of the loop it travels round.

$$Zs = Ze + (R1 + R2)$$

Ze = the external part, transformer to your origin · **R1 + R2** = line plus CPC of your own circuit, from a continuity test



The fault current leaves on the line conductor, through the fault, and returns through the CPC to earth. Everything it travels through, inside and outside the installation, adds up to **Zs**.

↓ **You want Zs LOW.** Low impedance means a big fault current, and a big fault current trips the device fast. A high Zs means a feeble fault current that may take far too long to operate the breaker — and the exposed metalwork stays live while someone is touching it.

Ze is the external part — the bit between the transformer and your consumer unit. The **expected** maximum values are given in the Electrician's Guide to the Building Regulations (p.53): **0.8 Ω** for a **TN-S** system and **0.35 Ω** for TN-C-S. Measure above that on a live test and you investigate — Guidance Note 3 notes that slightly higher readings are occasionally seen, and that comparing against previous readings tells you more than the number on its own. An unexplained high Ze is the distributor's to fix, not something you design around.

Zs vs Ze in one line.

Ze is everything outside your installation. **Zs** is Ze *plus* your own circuit's R1 + R2. Every circuit has its own Zs.

HOW MUCH CURRENT DOES IT TAKE TO TRIP?

A **type B** circuit breaker needs between **3 and 5 times** its rated current to trip in the fast part of its curve — and you always design to the **worst case, 5 times**.

```
50 A type B × 5 = 250 A of fault current needed
```

A 6 A type B needs 6 × 5 = **30 A**. That's where those multipliers in the On-Site Guide come from, and why a high-Zs circuit is dangerous: it can't deliver the current its own breaker needs.

Zs = Ze + (R1 + R2)

Electrician's Guide · p.53 · expected max Ze · TN-S 0.8 Ω · TN-C-S 0.35 Ω

On-Site Guide · Section 7 · Table 7.2.7 · trip current multipliers

---

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