CABLE CALCULATION, STEP 13: PROSPECTIVE FAULT CURRENT AND IA

HOW MUCH CURRENT FLOWS IN AN EARTH FAULT?

Prospective earth fault current (PEFC)

How many amps flow in the CPC during an earth fault? That's just Ohm's law, with one extra factor.

$$PEFC = (U_0 \times Cmin) \div Zs$$

Cmin = 0.95 for UK public LV supplies (Reg 411.4.4 Note 1)

Cmin is the minimum voltage factor. It allows for the supply voltage varying with time and place, and for low-voltage supplies it is 0.95. Lower voltage means lower fault current, so using 230 V on its own would fool you. We design to the **worst case**.

BS 7671 · Cmin explained · Reg 411.4.4 · **p.73**

WORKING

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PEFC = (230 × 0.95) ÷ 0.397
     = 218.5 ÷ 0.397
     = 550.4 A   (0.55 kA)
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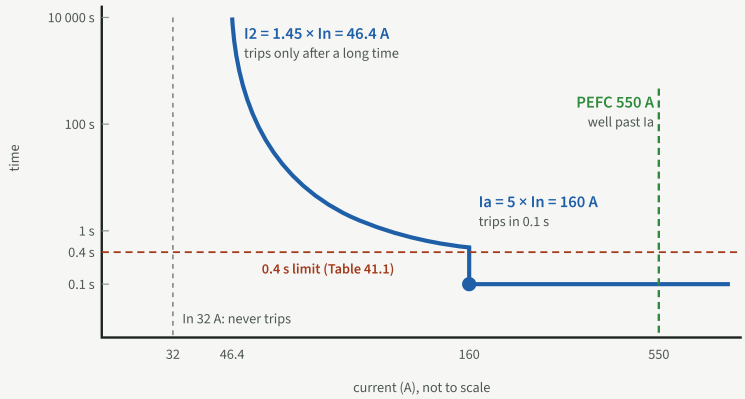
Ia: the current for instant disconnection

Now the question is: can the **6 mm² CPC** carry 550 A until the device trips? Think of it as a **seat belt**. It's tested well beyond the 70 mph limit, because it must hold even when something goes wrong. The CPC must outlast the protective device, so the device has to trip first.

Ia is the **minimum current** that makes the device operate **instantaneously**, which for a circuit-breaker means its fastest trip. The **Appendix 3** pages ("the graphs of many nightmares") each have a **table beside the graph**. Read the table, not the curves.

WORKING

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Fig 3A4 (Type B), 32 A → Ia = 160 A, trips in 0.1 s
PEFC 550.4 A exceeds Ia 160 A
→ the device will operate within 0.1 s during an earth fault
   (we need 0.4 s, so this is even better)
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A sketch (not to scale) of how to read a Type B curve for a 32 A device. The top of the Appendix 3 graphs is the long-time end (where I2 lives). The bottom is the instantaneous region (Ia).

The graph agrees with the table: follow the 32 A curve down to the bottom and it lands at about 160 A. (About 46.4 A sits at the top of the 32 A line, which is the I2 from step 9.)

> **BS 7671** · Appendix 3 · Fig 3A4 · Type B circuit-breakers (table of Ia beside the graph) · **p.445**

Don't forget the **RCD** in the RCBO. We've ignored it in the calculation (it's there because the regs demand it), so the circuit is even safer than the numbers show.

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