CABLE CALCULATION, STEP 9: REG 433.1.1 AND I2

WHAT IS I2, AND WHY 1.45?

Regulation 433.1.1 is a long regulation that boils down to two conditions:

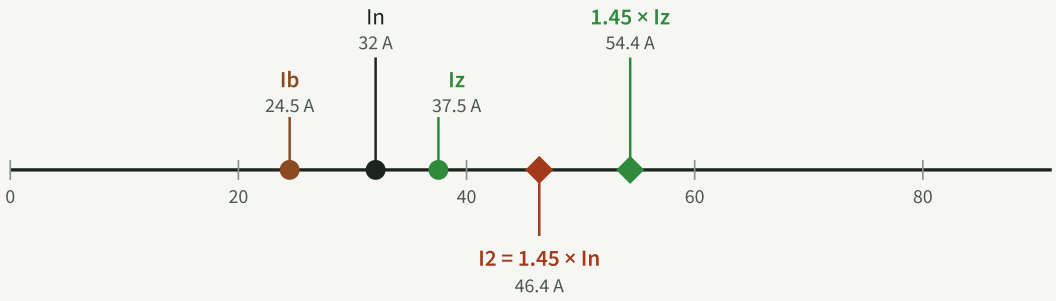
> `Ib ≤ In ≤ Iz` and `I2 ≤ 1.45 × Iz`
> (Iz is the cable's rating after the factors, see section 11)

I2 is the current that causes the protective device to **actually operate** (Reg 433.1.1(c)). A circuit-breaker marked 32 A doesn't trip at 32.1 A, 33 A, 35 A, 40 A or even 42 A. For a circuit-breaker, **I2 = 1.45 × In**.

WORKING

```
Iz        = 57 × 0.94 × 0.7      = 37.5 A
1.45 × Iz = 1.45 × 37.5          = 54.4 A
I2        = 1.45 × In = 1.45 × 32 = 46.4 A

24.5 ≤ 32 ≤ 37.5 ✓
46.4 A ≤ 54.4 A ✓   → Section 433 met: the cable won't overheat
```



The design line for the cooker circuit (after diversity). Iz is the 57 A table value after the factors.

The rubber band

Cut a rubber band so it's a strip. Pull it until it just stops sagging: that's **In**. Stretch it to **1.45 times** that length and leave it: eventually it snaps. That's **I2**, the device tripping on a sustained overload after a long time. Yank it hard and it snaps instantly: that's **Ia**, the instantaneous trip (step 13).

Why the slack? Diversity. If the tenants do all cook at once (three pans of pasta on full and a pizza in the oven), the circuit can draw more than the 24.5 A you

designed for. I2 gives the device room to "stretch" over that period without tripping, while the cable (sized for this) stays safe.

> **Watch out: two details**1) A common mix-up is that I2 trips "after 10,000 seconds, about two hours". 10,000 s is just the **top of the time axis** on the Appendix 3 graphs (and it's nearer 2¾ hours). For circuit-breakers up to 63 A, the standard **conventional time** for I2 is **1 hour**.
> 2) Iz is the cable's rating **after** the factors (37.5 A), not the 57 A table figure. 1.45 × 57 = 82.65 A would flatter the check; 1.45 × 37.5 = **54.4 A** is the real limit, and I2 46.4 A is still inside it. For circuit-breakers and RCBOs, I2 = 1.45 × In, so once In ≤ Iz, the I2 check is automatically met.

BS 7671 · Reg 433.1.1 · overload: Ib ≤ In ≤ Iz and I2 ≤ 1.45 Iz (433.1.1(c)) · **p.103**

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