# THE ELEVEN STEPS OF CABLE SELECTION: DESIGN CURRENT AND IN

**A 9 KW SHOWER. WHAT'S THE DESIGN CURRENT?**

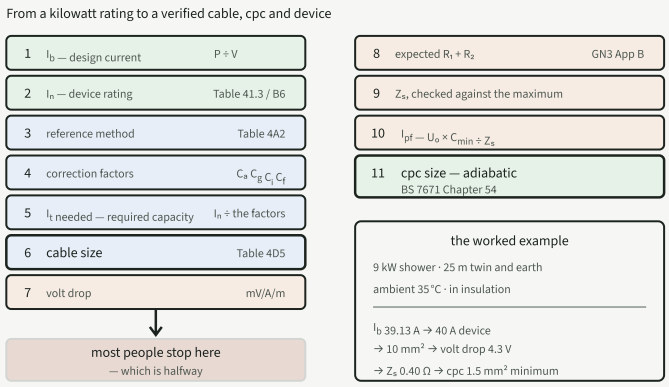
## THE ELEVEN STEPS OF CABLE SELECTION

From a kilowatt rating to a verified cable, CPC and protective device. Most people stop around step 7, at volt drop — which is halfway.

| STEP | FIND | WHERE |
|---|---|---|
| 1 | $I_b$ — design current | P ÷ V |
| 2 | $I_n$ — device rating | Table 41.3 / B6 / A6 |
| 3 | **Reference method** | BS 7671 Appendix 4, Table 4A2 |
| 4 | **Correction factors** | Appendix 4 — $C_a$, $C_g$, $C_i$, $C_f$ |
| 5 | $I_t$ needed — required capacity | $I_n$ ÷ the factors |
| 6 | $I_t$ — tabulated capacity → **cable size** | Table 4D5 for twin and earth |
| 7 | **Volt drop** | Same table — mV/A/m |
| 8 | **Expected $R_1$+$R_2$** | GN3 Appendix B / OSG Appendix I |
| 9 | $Z_s$, checked against the maximum | $Z_e$ + ($R_1$+$R_2$) |
| 10 | $I_{pf}$ | $U_0$ × $C_{min}$ ÷ $Z_s$ |
| 11 | **CPC size** — adiabatic | BS 7671 Chapter 54 |

**The worked example that follows:**

a **9 kW shower**, 25 m of twin and earth, ambient **35 °C**, run over the joists in a ceiling under thermal insulation, protected by an RCBO. $Z_e$ given as 0.21 Ω.




Steps 1 to 7 size the cable. Steps 8 to 11 prove it will actually disconnect in time and that the cpc will survive the fault — which is the part that makes it a design rather than a guess.

## STEP 1 — DESIGN CURRENT

$$I_b = P \div V = 9000 \div 230 = 39.13 \text{ A}$$

## STEP 2 — $I_n$, AND WHETHER DIVERSITY APPLIES

$$I_n = 40 \text{ A Type B RCBO}$$

Check Table A2 before assuming diversity. For an **instantaneous water heater or shower**, the entry is either **100% of the largest** appliance or **no diversity allowed** — so either way, the full 39.13 A stands. Nothing to reduce.

> **A cooker would be different.**
> That is where the Table A1/A2 arithmetic earlier comes in. A shower does not get it.

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