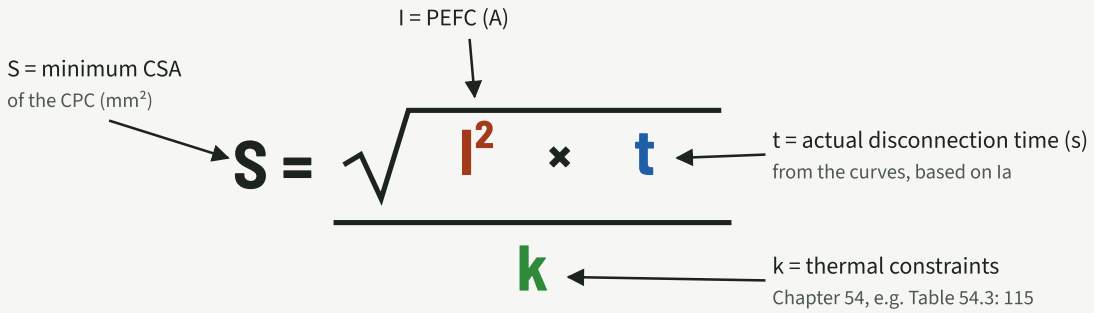
THE ADIABATIC EQUATION, AND WHEN TO USE IT

WILL THE CPC SURVIVE THE FAULT?

What it's for: the final calculation. It checks whether the **CPC can carry the prospective fault current for as long as the device takes to operate**. In an earth fault you might have several hundred amps in the CPC. It's a piece of copper, and it can't carry unlimited current. At some point it would melt, and that could cause a fire. After, say, 0.4 s the fuse blows and everything "chills out". The question is whether the CPC survives until then.



What each letter means. The answer **S** is the **minimum CSA the CPC is allowed to be**. Any smaller and it would melt before the device operates.

WHAT IS K?

k covers the **thermal constraints** of the conductor under fault current: its material, its insulation and how warm it already is. Some analogies:

- **Running up a hill:** someone in their mid-50s, a few extra pounds, not feeling their best, will take a while. Twenty years younger, they'd have scarpered up it. Same hill, different constraints.
- **A CPC in twin and earth** is nestled between a line and a neutral, both "cooking away" with current, so it's already warm. A CPC formed by the **steel wire armour of an SWA** sits round the outside in fresh air with nothing heating it. Different constraints, so different k.
- **A huge plate of food:** "I only ate an hour ago, I can't fit any more in." It depends on the constraints of your belly at the time.

Where to find k Use **Chapter 54**. It gives a far wider range of k values for protective conductors. k also appears in **Table 43.1**, but that's for a **different calculation**, so don't use it for earth faults.
For a CPC in **70 °C thermoplastic twin and earth** (copper), **Table 54.3** gives **k = 115**. Underneath, it asks whether the conductor is **bigger than 300 mm²**. If yes, use **103**. A 1.5 mm² CPC is much smaller than that, so it's **115**.

BS 7671 · Chapter 54 · values of k for protective conductors

BS 7671 · Table 54.3 · 70 °C thermoplastic, copper: k = 115 (103 above 300 mm²)

A hypothetical: you do the sum and get **1.3 mm²**. You've got a **1.5 mm²** CPC, so "I'm all right". Here's a full numbers example using the fuse values above.

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ANOTHER EXAMPLE: 20 A BS 3036 FUSE, 1.5 MM² T&E CPC
I = 130 A (just enough for 0.4 s, from the table above)
t = 0.4 s
k = 115 (Table 54.3, 70 °C thermoplastic, copper)

S = √(I² × t) ÷ k
  = √(130² × 0.4) ÷ 115
  = √(16 900 × 0.4) ÷ 115
  = √6760 ÷ 115
  = 82.22 ÷ 115
  = 0.71 mm²  (minimum)

1.5 mm² CPC ≥ 0.71 mm² ✓  the CPC survives until the fuse blows
```

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