DESIGN CURRENT IB: SINGLE-PHASE AND THREE-PHASE

WHAT'S IB ON A THREE-PHASE CIRCUIT?

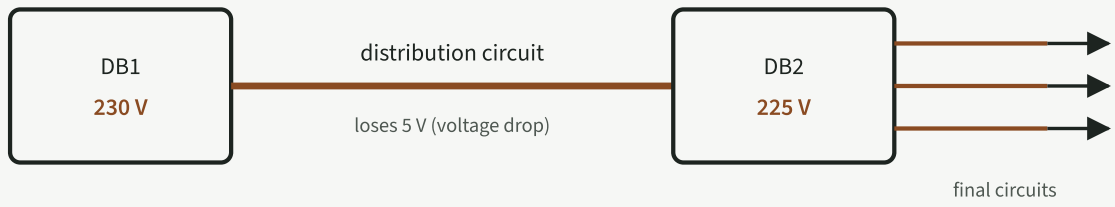
DESIGN CURRENT IB: SINGLE-PHASE

What it's for: finding how many amps a circuit will draw. That's the **design current**, `Ib` (capital I, small b). It's the first number in every design, and it depends only on the load.

$$Ib = P \div V$$

P = total wattage of the load (W) · V = voltage **present at the origin of the circuit** (V) · Ib in amps (A). It's the power triangle with I covered.

Be careful not to say "always use 230 V". It's normally U_0, the voltage to earth, **230 V**. But really it's the voltage **present** at the point where the circuit starts.



Final circuits from DB2: work out Ib with 225 V, not 230 V

Our sketch. A distribution circuit from DB1 to DB2 drops 5 V, so only **225 V** is present at DB2. For final circuits leaving DB2, use 225 V. Work with the voltage that's actually there.

ANOTHER EXAMPLE: THE SAME LOAD AT DB1 AND AT DB2

```
3 kW heater on a final circuit
From DB1 (230 V):  Ib = 3000 ÷ 230 = 13.04 A
From DB2 (225 V):  Ib = 3000 ÷ 225 = 13.33 A
Less voltage → a little more current for the same power.
```

8 A).

Level 3 vs Level 4

You may also see √3 and a **power factor** brought into current calculations. Power factor is Level 4 design work, so it's left out here. At Level 3, when you want the amps in a circuit, use the **power triangle**: `I = P ÷ V`. (If you know the volts and the resistance instead, that's Ohm's law, `I = V ÷ R`.)

DESIGN CURRENT IB: THREE-PHASE

What it's for: the design current of a three-phase circuit, where the load is **spread across the three phases**. The answer is the current **per phase**.

$$Ib = P \div (\sqrt{3} \times V_L)$$

P = total power (W) · V_L = voltage **between lines**, normally **400 V** · √3 = 1.73 · Ib in amps **per phase**

Unlike single-phase, you **don't** use the 230 V to earth (less any volt drop). Three-phase Ib is based on the **400 V** between lines. If you don't like the √ key on your calculator, just type **1.73**.

WORKED EXAMPLE: 5 KW THREE-PHASE CIRCUIT

```
Ib = P ÷ (√3 × VL)
   = 5000 ÷ (1.732 × 400)
   = 5000 ÷ 692.8
   = 7.22 A per phase     (some sources give 7.21 A, just rounding)

L1, L2 and L3 each carry about 7.2 A
→ a 10 A circuit breaker would do.
```

You'll also hear it as "5000 over 400, divided by √3". That's the same sum: 5000 ÷ 400 = 12.5, then 12.5 ÷ 1.732 = 7.22 A.

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