Generator sets I_{sc}

An alternator's internal impedance depends on its manufacture. This can be characterised as values expressed in%:

- X'd transient reactance:
  - 15 to 20% for a turbo-generator
  - 25 to 35% for salient polar alternator (subtransient reactance is negligible).
- X'o homopolar reactance: this can be estimated at 6% in the absence of more precise indications.

The following may be calculated:

$$I_{sc3} = \frac{k_3 \times P}{U_0 \times X'd}$$

$$I_{sc2} = 0.86 \times I_{sc3}$$

$$I_{sc1} = \frac{k_1 P}{U_0 (2X'd + X'0)}$$

P: alternator power in kVA
U_o: phase to neutral voltage
X'd: transient reactance
$k_3 = 0.37$ for I_{sc3} max
$k_3 = 0.33$ for I_{sc3} min

X'$_o$: homopolar reactance
$k_1 = 1.1$ per I_{sc1} max
$k_1 = 1.1$ per I_{sc1} min

Example: P = 400 kVA X'd = 30% X'0 = 6% U_0 = 230 V

$$I_{sc3}\ \text{max} = \frac{0.37 \times 400}{230 \times \frac{30}{100}} = 2.14\ \text{kA} \qquad I_{sc1}\ \text{max} = \frac{1.1 \times 400}{230 \times \left[2 \times \frac{30}{100} + \frac{6}{100}\right]} = 2.944\ \text{kA}$$

I_{sc2} max = 1.844 kA