

Capacitor Inrush Current Calculations

This shows the derivation of the inrush calculations from IEEE C37.99.

Energizing A Isolated Bank:

$$I_{MAX} = \sqrt{2} * V_{LG} \sqrt{\frac{C_B}{LS}} \quad (1)$$

C_B is the bank capacitance in microfarads
 LS is the system inductance in microhenries.

As stated $KVAR = \frac{V^2 * 2\pi F * C * 10^{-6}}{1000}$ from (16)

$$\therefore C_B = \frac{KVAR * 10^9}{V^2 * (2\pi F)} \quad (2)$$

Then Substitute C_B from (20) with formula (21) we get

$$I_{MAX} = \sqrt{2} * V_{L-G} \sqrt{\frac{\left[\frac{KVAR * 10^9}{(V^2 * (2\pi F))} \right]}{LS}} \quad (3)$$


→ **Peak to Peak**

$$I_{MAX} = \sqrt{2} * V_{L-G} * \sqrt{\frac{\left(\frac{KVAR * 10^9}{(V_{L-L}^2 * (2\pi F))} \right)}{LS}} \quad (4)$$

$\sqrt{10^9} \approx 31,622.8$
 $\sqrt{(2\pi F)} \approx 19.4163@60Hz$
 $17.7245@50Hz$

Then

$$I_{MAX} = \frac{\sqrt{2} * V_{L-G} * 31,622.8}{19.4163} * \sqrt{\frac{\left(\frac{KVAR}{V^2}\right)}{LS}} \quad (5)$$



$$LET = (V_{L-G} * \sqrt{3})^2$$

This will allow us to re-arrange (5) to the following

$$I_{MAX} = \frac{\sqrt{2} * V_{L-G} * 31,622.8}{\sqrt{3} * V_{L-G} * 19.4163} * \sqrt{\frac{KVAR}{LS}} \quad (6)$$

$$\cong ((0.81649658) * (1628.673)) * \sqrt{\frac{KVAR}{LS}} \quad (7)$$

Giving us the following inrush formulas

$$\cong 1330 \sqrt{\frac{KVAR}{LS}} \text{ For 60 Hz} \quad (8)$$

$$\cong 1456.7 \sqrt{\frac{KVAR}{LS}} \text{ For 50 Hz} \quad (9)$$

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