

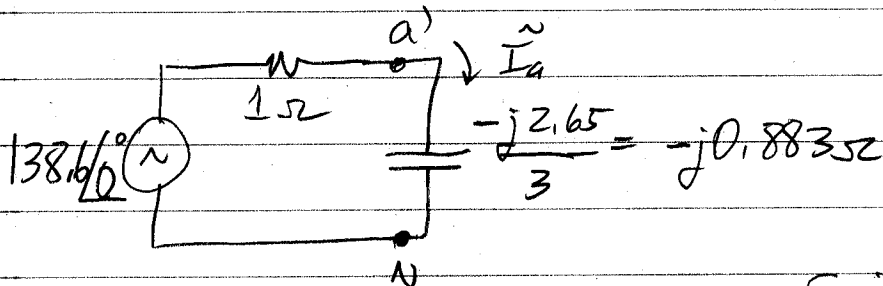
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Z₀ Balanced → use one-line with line-to-neutral voltages

$$f = 60 \text{ Hz}, C = 10^{-3} \text{ F}, \frac{1}{j\omega C} = \frac{1}{j(120\pi)(10^{-3})} = -j2.65 \Omega$$

$$\tilde{V}_{AN} = \frac{240}{\sqrt{3}} \angle 0 = 138.6 \angle 0 \text{ V}$$

Putting the Z_C in a wye requires that we divide Z_C by 3.



Voltage divider, $V_{a'n} = 138.6 \angle 0 \left[\frac{-j0.883}{1 - j0.883} \right]$

$$V_{a'n} = 138.6 \angle 0 \left[\frac{0.883 \angle -90}{1.334 \angle -41.4} \right] = 91.7 \angle -48.6 \text{ V}$$

Also, $\tilde{I}_a = \frac{138.6 \angle 0}{1.334 \angle -41.4} = 103.9 \angle 41.4^\circ \text{ A}$

$$S_{1\phi \text{ TOTAL}} = V_{a'n} \tilde{I}_a^* = (138.6 \angle 0)(103.9 \angle -41.4) = 14.4 \angle -41.4 \text{ KVA}$$

$$S_{1\phi \text{ TOTAL}} = 10.8 \text{ kW} - j9.53 \text{ KVAR}$$

Check $|\tilde{I}|^2 R = (103.9)^2 (1) = 10.8 \text{ kW}$ OK

$|\tilde{I}|^2 X_C = (103.9)^2 (-0.883) = -9.53 \text{ KVAR}$ OK

Also check at the load

$$S_{\text{LOAD } 1\phi} = V_{a'n} \tilde{I}_a^* = (91.7 \angle -48.6)(103.9 \angle 41.4) = 9.53 \angle -90 \text{ V}$$

From symmetry, $S_{\text{LOAD } 3\phi} = 3S_{\text{LOAD } 1\phi} = -j28.6 \text{ KVAR}$

$$V_{a'b'} = \sqrt{3} V_{a'n} \angle 30 = 158.9 \angle -18.6 \text{ V}, I_b = I_a \angle -120 = 103.9 \angle -78.6$$