GIVEN: Z_Δ w/ 6KW pf = 0.8 LAG PER ϕ

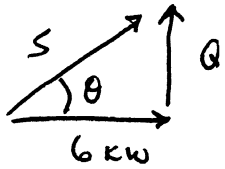
$V_L = 240V$

FIND: A) Z_Δ

B) I_L

C) C FOR MIN CURRENT

SOLN: POWER TRIANGLE ... PER ϕ



$\theta = \cos^{-1}(0.8) = 36.87^\circ$

$Q = P\tan(\theta) = 4.5$ KVAR

$$S_\phi = P + jQ = V_\phi I_\phi^* \qquad (6K + j4.5K) = \frac{V_L^2}{Z_\Delta^*}$$

$$\therefore \underline{Z_\Delta = 7.68 \angle 36.87^\circ \ \Omega}$$

NOW $S_T = 3S_\phi = \sqrt{3}\, V_L I_L$ $\qquad |S_T| = 22.5\text{KVA} = \sqrt{3}(240)(I_L)$

$$\underline{I_L = 54.13 \angle -66.87^\circ \ A_{RMS}}$$

TO MINIMIZE CURRENT – pf = 1 SO WE NEED

$$Q_c = 4.5\text{KVAR} = \frac{V^2}{\omega C}$$

$$\therefore \underline{C = 34\,mF}$$

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GIVEN: $S_T = 9.6$ KVA

$V_\phi = 208$ V - FOR WYE CONNECTION

$pf = 0.9$ LAG

FIND: A) I_L B) V_L

SOLN: $S_T = \sqrt{3}\, V_L I_L$

NOW FOR A WYE: $V_L = (\sqrt{3}\angle 30)(V_\phi)$

$$\underline{V_L = 360.3 \angle 30^\circ \text{ V}_{RMS}}$$

AND $9.6K = \sqrt{3}\,(360.3)\,|I_L|$

$$|I_L| = 15.4 \text{ A}$$

$pf \rightarrow \theta = 25.8^\circ$

SO, $\underline{I_L = 15.4 \angle 4.2^\circ \text{ A}_{RMS}}$

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GIVEN: $V_L = 4200\ V$ $\quad Z_L = 4 + j\ \Omega$

$S_T = 1\ MVA$ $\quad pf = 0.75$ LAG - FOR LOAD

FIND: A) S OF SOURCE

B) LINE LOSS

C) VOLT AT SOURCE

SOLN: LET'S FIND I_L ... $\quad S_T = \sqrt{3}\, V_L I_L$

$1\ MVA = \sqrt{3}\,(4200)(I_L)$ $\quad I_L = 137.5 \angle 41.4^\circ\ A_{RMS}$

$pf \rightarrow \theta = 41.4^\circ$

NOW FOR THE LINE... $\quad S_{LINE} = 3(V_L)(I_L) = 3(Z_L)(I_L)^2$

$S_{LINE} = 233.7\ KVA$ $\quad pf = 0.97$ LAG

AND THE SOURCE SUPPLIES ALL LINE & LOAD POWER

SO,

$$S = \overbrace{(750 + j661.4)}^{\text{LOAD TOTAL}}\ KVA + \overbrace{(226.8 + j56.5)}^{\text{LINE TOTAL}}\ KVA$$

$S = 1.2\ MVA$ $\quad pf = 0.81$ LAG

AT SOURCE ... $\quad S = \sqrt{3}\, V_L I_L$ $\quad 1.2\ MVA = (\sqrt{3})(137.5)(V_L)$

$V_L = 5038.7 \angle 77.3^\circ\ V_{RMS}$

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