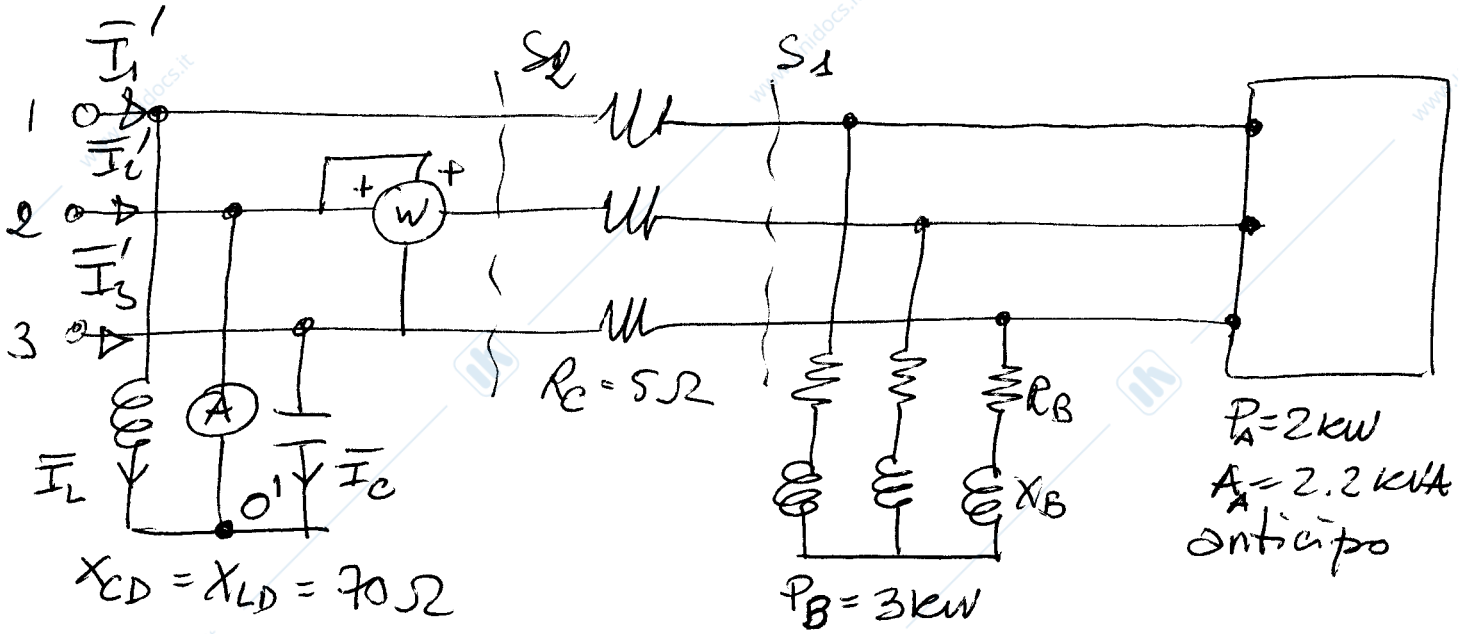
ESERCIZIO



$X_{CD} = X_{LD} = 7\Omega$

$P_B = 3kW$

$Q_B = 1.5kVAr$

$R_B = 4\Omega$

$W = ?$

$A = ?$

$\bar{I}_1', \bar{I}_2', \bar{I}_3' = ?$

CARICO B

$$P_B = 3 R_B I_B^2 \rightarrow I_B = \sqrt{\frac{P_B}{3R_B}} = 5A$$

$$E_B = \sqrt{R_B^2 + X_B^2}\, I_B = 224V$$

$$\frac{Q_B}{P_B} = tg\varphi_B$$

$$\varphi_B = 27^\circ = tg^{-1}\frac{X_B}{R_B}$$

Quindi

$$tg^{-1}\frac{X_B}{R_B} = tg^{-1}\frac{Q_B}{P_B} \rightarrow X_B = R_B\frac{Q_B}{P_B} = 2\Omega$$

In alternativa:

$$P_B = 3 E_B I_B \cos\varphi_B \rightarrow E_B = \frac{3000}{3 \cdot 5 \cdot \cos 27^\circ} = 224\ V$$

Alla sezione S_1:

$$P_{S1} = P_B + P_A = 5000 \text{ W}$$

$$Q_{S1} = Q_B + Q_A \quad \text{con:}$$

$$A_A = \sqrt{P_A^2 + Q_A^2} \rightarrow |Q_A| = \sqrt{A_A^2 - P_A^2} = 917 \text{ VAr}$$

per cui dall'indicazione "anticipo" è:

$$Q_A = -917 \text{ VAr}$$

Quindi:

$$S_1 \begin{cases} P_{S1} = 5000 \text{ W} \\ Q_{S1} = 1500 - 917 = 583 \text{ VAr} \\ E_{S1} = E_B = 224 \text{ V} \end{cases} \rightarrow I_{S1} = \frac{\sqrt{P_{S1}^2 + Q_{S1}^2}}{3E_{S1}} = 7.5 \text{ A}$$

Alla sezione S_2:

$$S_2 \begin{cases} P_{S2} = P_{S1} + 3 \cdot R_C \cdot I_{S1}^2 = 5844 \text{ W} \\ Q_{S2} = Q_{S1} = 583 \text{ VAr} \\ I_{S2} = I_{S1} = 7.5 \text{ A} \end{cases} \rightarrow E_{S2} = \frac{\sqrt{P_{S2}^2 + Q_{S2}^2}}{3I_{S2}} = 261 \text{ V}$$

posto $\bar{E}_1$ a fase nulla si ha:

$$\bar{E}_1 = 261 \, e^{j0} \rightarrow \bar{V}_{12} = 261 \, e^{j30^\circ} \; ; \; \bar{V}_{23} = 261 \, e^{-j90^\circ}$$

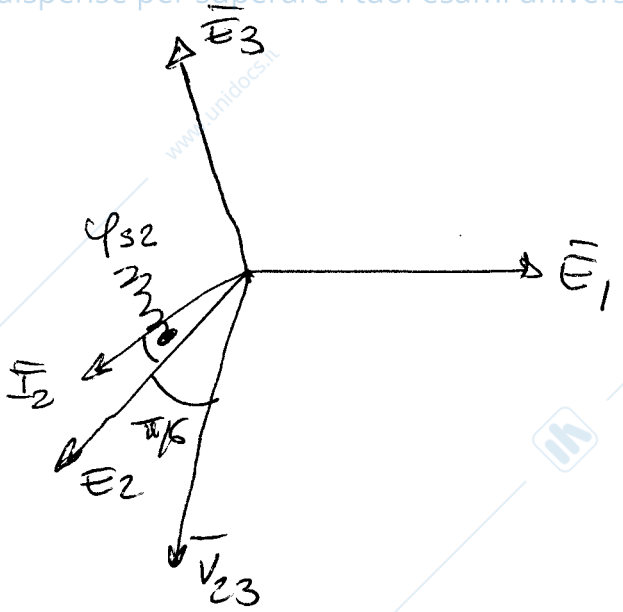
$$\bar{I}_1 = 7.5 \, e^{-j6^\circ}$$

↑ nota: la fase è stata calcolata osservando che $Q_{S2} > 0$ (corrente in ritardo) e che $\varphi_{S2} = \operatorname{tg}^{-1} \frac{Q_{S1}}{P_{S2}} = 6^\circ$

$$W = \bar{V}_{23} \cdot \bar{I}_2 =$$

$$= \sqrt{3} E_{S2} I_{S2} \cos(30° + 6°) =$$

$$= 2743 \text{ W}$$



Rigirando il circuito equilibrato, si ha:

$$\bar{V}_{20'} = 0$$

$$\bar{I}_L = \frac{\bar{V}_{10'}}{jX_{LD}} = \frac{\bar{V}_{12}}{jX_{LD}} = \frac{261 e^{j30°}}{j70} = 1.86 - j\,3.23$$

$$\bar{I}_C = \frac{\bar{V}_{30'}}{-jX_{CD}} = \frac{\bar{V}_{32}}{-jX_{CD}} = \frac{-261 e^{-j90°}}{-j70} = -3.73$$

Infine:

Lettura amperometro $\rightarrow |\bar{I}_L + \bar{I}_C| = 3.73$ A

$$\bar{I}_1' = \bar{I}_1 + \bar{I}_L = 9.32 - j\,4.01$$

$$\bar{I}_2' = \bar{I}_2 - (\bar{I}_L + \bar{I}_C) = 2.54 - j\,2.84$$

$$\bar{I}_3' = \bar{I}_3 + \bar{I}_C = -6.78 + j\,6.85$$