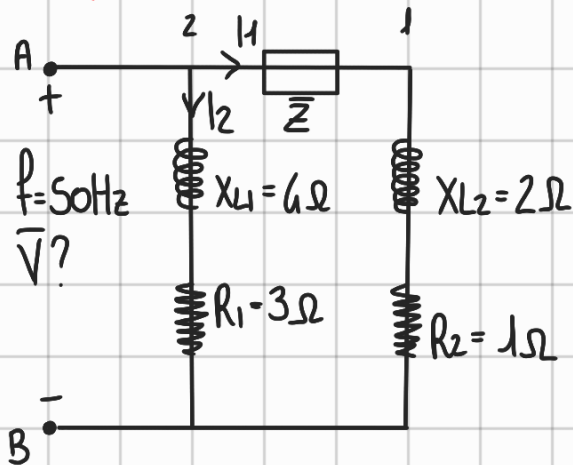


25 MAGGIO 2011 es. 6



• $\bar{Z}$ $A_z = 2000 \text{ VA}$
 $V_z = 100 \text{ V}_{\text{eff}}$
 $\cos \varphi_z = 0,8$

Determina P e Q di AB ed effettua un rifasamento completo

• $P_z = A_z \cos \varphi_z = 2000 \cdot 0,8 = 1600 \text{ W}$ • $Q_z = \sqrt{A_z^2 - P_z^2} = 1200 \text{ VAR}$

$I_1 = \frac{A_z}{V_z} = \frac{2000}{100} = 20 \text{ A}_{\text{eff}} \Rightarrow$ • $Q_{L2} = X_{L2} \cdot I_1^2 = 2 \cdot 20^2 = 800 \text{ VAR}$

• $P_{R2} = R_2 I_1^2 = 1 \cdot 20^2 = 400 \text{ W}$

$A_1 = \sqrt{(P_z + P_{R2})^2 + (Q_z + Q_{L2})^2} = 2828 \text{ VA}$

$V_1 = \frac{A_1}{I_1} = \frac{2828}{20} = 141,42 \text{ V}_{\text{eff}} = V_z = V_{AB}$

$I_2 = \frac{V_1}{|Z_{z1}|} = \frac{V_1}{\sqrt{X_{L1}^2 + R_1^2}} = \frac{141,42}{\sqrt{4^2 + 3^2}} = 28,28 \text{ A}_{\text{eff}}$

• $Q_{L1} = X_{L1} I_2^2 = 4 \cdot 28,28^2 = 3200 \text{ VAR}$

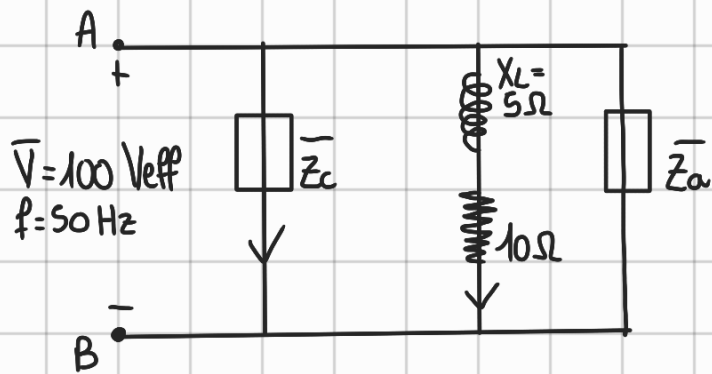
• $P_{R1} = R_1 I_2^2 = 3 \cdot 28,28^2 = 2400 \text{ W}$

$\Rightarrow P_{AB} = P_z + P_{R1} + P_{R2} = 6600 \text{ W}$ $Q_{AB} = Q_z + Q_{L1} + Q_{L2} = 5200 \text{ VAR}$

$A_{AB} = \sqrt{P_{AB}^2 + Q_{AB}^2} = 6812 \text{ VA}$

$C = \frac{Q_{AB}}{2\pi f V_{AB}^2} = \frac{5200}{2\pi 50 \cdot 141,42^2} = 827 \mu \text{ F}$

29 GIUGNO 2020 es 2



$$\bar{Z}_a \quad A_a = 2 \cdot 10^3 \text{ VA}$$

$$\cos \varphi_a = 0,8$$

$$\bar{Z}_c \quad A_c = 3 \cdot 10^3 \text{ VA} \quad I_{\text{reatt}} = 10 \text{ Aeff}$$

- fattore di potenza da a+b e a+b+c
- rifasamento che elevi AB $\cos \varphi_{AB} = 0,95$

Analizza a $A_a = V \cdot I_a \Rightarrow I_a = \frac{A_a}{V} = 20 \text{ Aeff}$

$$P_a = A_a \cos \varphi_a = 2 \cdot 10^3 \cdot 0,8 = 1600 \text{ W}$$

$$Q_a = \sqrt{A_a^2 - P_a^2} = 1200 \text{ VAR}$$

Analizza c $Q_c = V I_{\text{reatt}} = 100 \cdot 10 = 1000 \text{ VAR}$

$$P_c = \sqrt{A_c^2 - Q_c^2} = 2828,42 \text{ W}$$

Analizza b $I = \frac{V}{|Z|} = \frac{100}{\sqrt{5^2 + 10^2}} = 8,94 \text{ Aeff}$

$$P_R = R I^2 = 800 \text{ W} \quad Q_L = 5 I^2 = 400 \text{ VAR}$$

$$P_{\text{TOT}} = 5228 \text{ W}$$

$$A_{\text{TOT}} = 5838,83 \text{ VA}$$

$$Q_{\text{TOT}} = 2600 \text{ VAR}$$

$$I_{AB} = \frac{A_{\text{TOT}}}{V} = 58 \text{ Aeff}$$

$$C = \frac{Q_{\text{TOT}} - P_{\text{TOT}} \tan(\arccos(0,95))}{2\pi f V^2} = 280 \mu\text{F}$$

$$Z_c = \frac{1}{j2\pi f C} = -11,36j$$

$$Q_c = Z_c I^2 = -11,36 \cdot 8,94^2 = -907 \text{ VA}$$

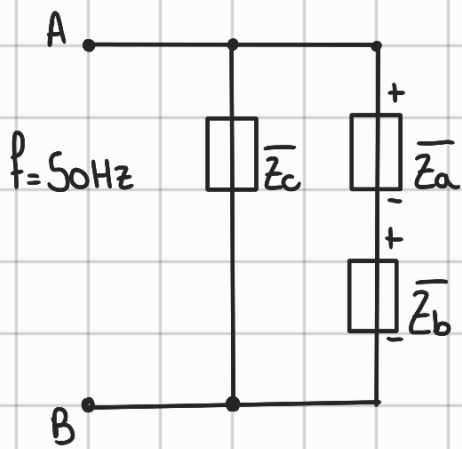
$$Q_{\text{TOT DOPO}} = Q_{\text{TOT}} + Q_c = 2600 - 907 = 1693$$

$$A_{\text{DOPO}} = \sqrt{5228^2 + 1693^2} = 5495,29$$

$$I_{AB \text{ DOPO}} = \frac{A_{\text{DOPO}}}{V} = 54,95 \text{ Aeff}$$

$$\Delta I_{AB} = 3,4 \text{ Aeff}$$

16 LUGLIO 2020 es. 2



$$\bar{Z}_a: \bar{V}_a = 100 \text{ Veff} \\ A_a = 2000 \text{ VA} \\ \cos \varphi_a = 0,8$$

$$\bar{Z}_b: \bar{V}_b = 100 \text{ Veff} \\ I_{batt} = 10 \text{ Aeff}$$

$$\bar{Z}_c: Z_c = 20 \Omega \\ \cos \varphi_c = 0,6$$

Effettua un rifasamento che elevi il fattore di potenza di AB a 0,95
Valuta la diminuzione di corrente di AB (Aeff)

$$\bar{Z}_a: P_a = A_a \cos \varphi_a = 2000 \cdot 0,8 = 1600 \text{ W} \quad \leadsto A = VI \quad I = \frac{A}{V} = \frac{2000}{100} = 20 \text{ A} \\ Q_a = \sqrt{A_a^2 - P_a^2} = 1200 \text{ VAR}$$

$$\bar{Z}_b: P_b = V_b \cdot I_{batt} = 100 \cdot 10 = 1000 \text{ W} \quad A_b = VI = 100 \cdot 20 = 2000 \text{ VA} \\ Q_b = \sqrt{A_b^2 - P_b^2} = 1732 \text{ VAR}$$

$$A_{ab} = \sqrt{(P_a + P_b)^2 + (Q_a + Q_b)^2} = 3918 \text{ VA}$$

$$V_{ab} = \frac{A_{ab}}{I} = \frac{3918}{20} = 195,9 \approx 196 \text{ Veff}$$

$$\bar{Z}_c: V_c = 196 \text{ Veff} \\ I_c = \frac{V_c}{Z_c} = \frac{196}{20} = 9,8 \text{ Aeff} \quad A_c = V_c \cdot I_c = 196 \cdot 9,8 = 1920 \text{ VA}$$

$$P_c = A_c \cos \varphi_c = 1920 \cdot 0,6 = 1152 \text{ W}$$

$$Q_c = \sqrt{A_c^2 - P_c^2} = 1536 \text{ VAR}$$

$$P_{AB,1} = 3752 \text{ W} \quad Q_{AB,1} = 668 \text{ VAR} \\ A_{AB,1} = 5836,42 \text{ VA} \quad I_{AB,1} = \frac{A_{AB,1}}{V_c} = 29,76 \text{ Aeff}$$

$$C = \frac{Q_{AB,1} - P_{AB,1} \tan(\arccos(0,951))}{2\pi f V_c^2} = \frac{4668 - 3752 \tan(\arccos(0,951))}{2\pi 50 (196)^2}$$

$$= 268 \cdot 10^{-6} \text{ F}$$

$$Z_{cc} = \frac{1}{j2\pi f C} = \frac{1}{j2\pi 50 \cdot 268 \cdot 10^{-6}} = -11,87j \, \Omega$$

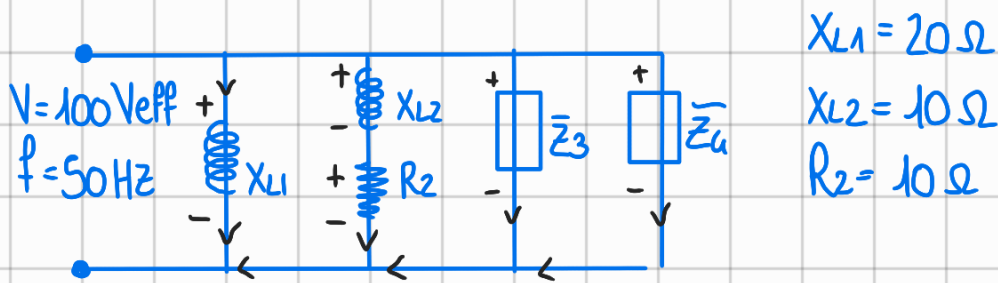
$$Q_{cc} = \frac{V_c^2}{Z_{cc}} = \frac{196^2}{-11,87j} = -3236,39 \text{ VAR}$$

$$Q_{DoPo} = 4668 - 3236 = 1231 \text{ VAR}$$

$$A_{DoPo} = 3968,78 \text{ VAR} \quad I_{DoPo} = \frac{A_{DoPo}}{V_c} = 20,16 \text{ Aeff}$$

$$\Delta I = 9,61 \text{ Aeff}$$

9 DIC 2008 es 3 OK



$\bar{Z}_3$: $I_{att3} = 5 \text{ Aeff}$
 $I_{reatt3} = 10 \text{ Aeff}$

$\bar{Z}_4$: $Z_4 = 10 \Omega$
 $\cos \varphi_4 = 0,8$

Effettua un rifasamento completo

• $X_{L1} \leadsto V = 100 \text{ Veff}$
 $Q_{L1} = \frac{V^2}{X_{L1}} = \frac{100^2}{20} = 500 \text{ VAR}$

• $\bar{Z}_3 \leadsto V = 100 \text{ Veff}$
 $P_3 = V I_{att3} = 100 \cdot 5 = 500 \text{ W}$
 $Q_3 = V I_{reatt3} = 100 \cdot 10 = 1000 \text{ VAR}$

• $\bar{Z}_4 \leadsto V = 100 \text{ Veff}$
 $A_4 = V I_4 = 100 \cdot 10 = 1000 \text{ VA}$
 $I_4 = \frac{V}{Z_4} = \frac{100}{10} = 10 \text{ A}$
 $P_4 = 1000 \cdot \cos \varphi_4 = 1000 \cdot 0,8 = 800 \text{ W}$
 $Q_4 = \sqrt{A_4^2 - P_4^2} = 600 \text{ VAR}$

• $X_{L2} + R_2$
 $V_{TOT} = 100 \text{ Veff}$
 $I_2 = \frac{V_{TOT}}{\sqrt{X_{L2}^2 + R_2^2}} = \frac{100}{\sqrt{10^2 + 10^2}} = 5\sqrt{2} \text{ A}$
 $Q_{L2} = X_{L2} \cdot I_2^2 = 10 (5\sqrt{2})^2 = 500 \text{ VAR}$
 $P_{R2} = R_2 I_2^2 = 10 (5\sqrt{2})^2 = 500 \text{ W}$

$Q_{TOT} = 2600 \text{ VAR}$ $P_{TOT} = 1800 \text{ W}$

$$C = \frac{Q_{TOT}}{2\pi f V^2} = \frac{2600}{2\pi 50 100^2} = 827 \cdot 10^{-6} \text{ F}$$

Calcola la diminuzione di corrente dopo il rifasamento

$$A_{PRIMA} = \sqrt{Q_{TOT}^2 + P_{TOT}^2} = \sqrt{2600^2 + 1800^2} = 3162 \text{ VA}$$

$$A = VI \quad I_{PRIMA} = \frac{A_{PRIMA}}{V} = \frac{3162}{100} = 31,62 \text{ Aeff}$$

$$C = 827 \cdot 10^{-6} \text{ F} \quad \bar{Z}_C = \frac{1}{j\omega C} = \frac{1}{j 2\pi 50 \cdot 827 \cdot 10^{-6}} = -3,84j \Omega$$

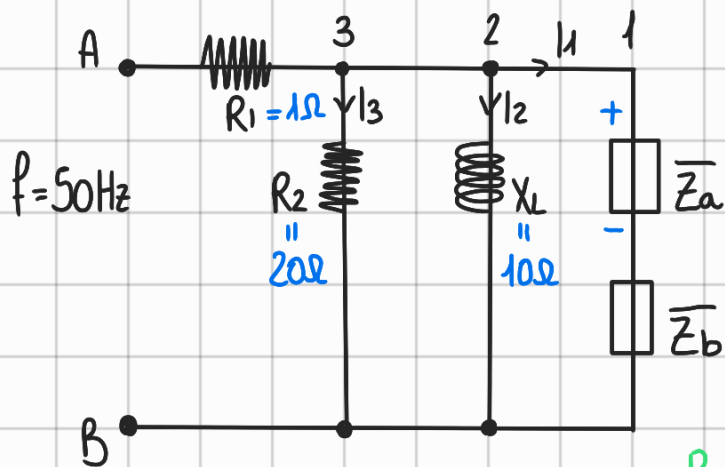
$$Q_C = \frac{V^2}{Z_C} = \frac{100^2}{-3,84} = -2604,1 \text{ VAR}$$

$$Q_{TOT} = -4 \text{ VAR} \quad A_{DOPO} = \sqrt{(-4)^2 + P_{TOT}^2} = 1800 \text{ VA}$$

$$I_{DOPO} = \frac{A_{DOPO}}{V} = \frac{1800}{100} = 18 \text{ A}$$

$$\Delta I = 31,62 - 18 = 13,62 \text{ Aeff}$$

7 GIU 2012



• $\bar{Z}_a$ $P_a = 1500 \text{ W}$ $\cos \varphi_a = 0,7$

$V_a = 100 \text{ V}_{\text{eff}}$

• $\bar{Z}_b$ $\cos \varphi_b = 0,3$ $V_b = 100 \text{ V}_{\text{eff}}$

Determinare P e Q di AB, $\cos \varphi_{AB}$ ed effettuare un rifasamento completo

• $A_a = \frac{P_a}{\cos \varphi_a} = \frac{1500}{0,7} = 2143 \text{ VA}$ $P_a = 1500 \text{ W}$
 $Q_a = \sqrt{A_a^2 - P_a^2} = 1531 \text{ VAR}$

• $I_1 = \frac{A_a}{V_a} = \frac{2143}{100} = 21,43 \text{ A}_{\text{eff}}$ • $A_b = V_b \cdot I_1 = 2143 \text{ A}_{\text{eff}}$
 • $P_b = A_b \cos \varphi_b = 2143 \cdot 0,3 = 643 \text{ W}$ • $Q_b = \sqrt{A_b^2 - P_b^2} = 2066 \text{ VAR}$

$P_1 = 2143 \text{ W}$ $Q_1 = -513 \text{ VAR}$ $\Rightarrow A_1 = \sqrt{P_1^2 + Q_1^2} = 2204 \text{ VA}$

$V_1 = V_2 = V_3$ $V_1 = \frac{A_1}{I_1} = \frac{2204}{21,43} = 103 \text{ V}_{\text{eff}}$

• $Q_L = \frac{V_1^2}{X_L} = \frac{103^2}{10} = 1061 \text{ VAR}$

• $P_{R2} = \frac{V_1^2}{R_2} = \frac{103^2}{20} = 530 \text{ W}$

$\Rightarrow P_3 = P_1 + P_{R2} = 2673 \text{ W}$ $Q_3 = Q_1 + Q_L = 548 \text{ VAR}$

$A_3 = \sqrt{P_3^2 + Q_3^2} = 2729 \text{ VA}$

$I_{AB} = \frac{A_3}{V_1} = \frac{2729}{103} = 26,49 \text{ A}_{\text{eff}}$

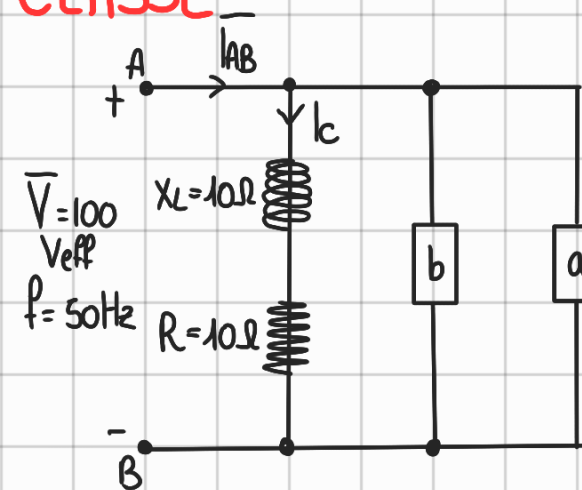
$P_{R1} = R_1 \cdot I_{AB}^2 = 26,49^2 = 702 \text{ W}$

$V_{AB} = \frac{A_{AB}}{I_{AB}} = 129,07 \text{ V}_{\text{eff}}$

$\Rightarrow P_{AB} = 3375 \text{ W}$ $Q_{AB} = 548 \text{ VAR}$ • $\cos \varphi_{AB} = \frac{P_{AB}}{A_{AB}} = 0,98$

$C = \frac{Q_{\text{TOT}}}{2\pi f V_{AB}^2} = \frac{548}{2\pi \cdot 50 \cdot 129,07^2} = 104 \cdot \mu\text{F}$

CLASSE



- $A_a = 1000 \text{ VA}$ $\cos\varphi_a = 0,8$
- $I_{att,b} = 5 \text{ Aeff}$ $I_{reatt,b} = 5 \text{ Aeff}$
- Effettua un rifasamento che elevi il fattore di potenza a 0,9 induttivo, valuta la diminuzione di corrente

- $P_a = A_a \cos\varphi_a = 1000 \cdot 0,8 = 800 \text{ W}$
- $Q_a = \sqrt{A_a^2 - P_a^2} = \sqrt{1000^2 - 800^2} = 600 \text{ VAR}$
- $P_b = V \cdot I_{att,b} = 100 \cdot 5 = 500 \text{ W}$
- $Q_b = V I_{reatt,b} = 100 \cdot 5 = 500 \text{ VAR}$

Ora trovo $I_c \leadsto I_c = \frac{V}{|Z_c|} = \frac{100}{\sqrt{10^2 + 10^2}} = 7,07 \text{ Aeff}$

$\Rightarrow$

- $P_R = R I_c^2 = 10 (7,07)^2 = 500 \text{ W}$
- $Q_L = X_L I_c^2 = 10 (7,07)^2 = 500 \text{ VAR}$

IN TOTALE:

$Q_{AB} = Q_a + Q_b + Q_L = 1600 \text{ VAR}$ $P_{AB} = P_a + P_b + P_R = 1800 \text{ W}$

• $A_{AB} = \sqrt{Q_{AB}^2 + P_{AB}^2} = 2408 \text{ VA}$

• Rifasamento con $\text{fattore} = 0,9$

$$C = \frac{Q_{AB} - P_{AB} \tan(\arccos(0,9))}{2\pi f V^2} = \frac{1600 - 1800 \cdot 0,48}{2\pi \cdot 50 \cdot 100^2} = 232 \mu\text{F}$$

• $I_{AB \text{ prima}} = \frac{A_{AB}}{V} = \frac{2408}{100} = 24,1 \text{ Aeff}$

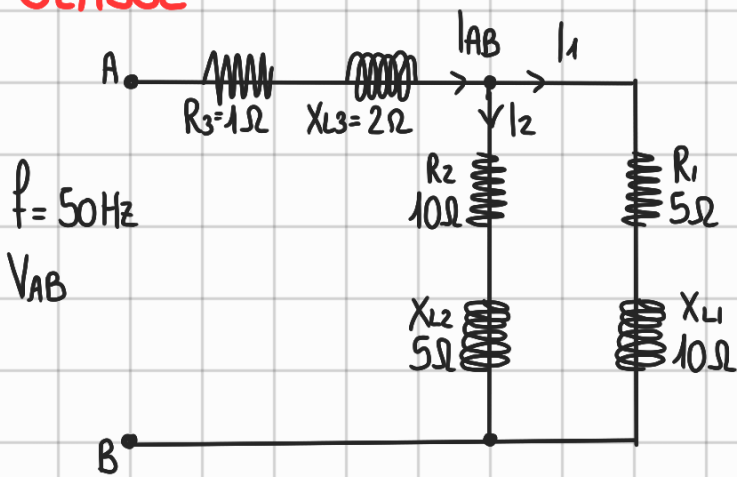
• $Q_C = \frac{V^2}{X_C} = \frac{100^2}{13,72} = 729 \text{ VAR}$

$A_{AB \text{ dopo}} = \sqrt{P_{AB}^2 + (Q_{AB} - Q_C)^2} = 2000 \text{ VA}$

$\hookrightarrow = \frac{1}{2\pi f C} = 13,72 \Omega$

• $I_{AB \text{ dopo}} = \frac{A_{AB \text{ dopo}}}{V} = \frac{2000}{100} = 20 \text{ Aeff} \Rightarrow \Delta I = 4,1 \text{ Aeff}$

CLASSE



$$Q_{L1} = 2000 \text{ VAR}$$

Determina P_{AB} , Q_{AB} , $\cos\varphi_{AB}$

Effettua un ziframento che elevi il fattore di potenza a 0,9 induttivo

$$Q_{L1} = X_{L1} I_1^2 \leadsto I_1 = \sqrt{\frac{Q_{L1}}{X_{L1}}} = \sqrt{\frac{2000}{10}} = 14,1 \text{ Aeff}$$

$$\text{quindi } P_{R1} = R_1 I_1^2 = 5 \cdot (14,1)^2 = 1000 \text{ W}$$

$$\text{Trovo } V_1 = I_1 |Z_1| = 14,1 \cdot \sqrt{R_1^2 + X_{L1}^2} = 158 \text{ Veff}$$

$$\text{Ora troviamo } I_2 = \frac{V_1 = V_2}{|Z_2|} = \frac{158}{\sqrt{10^2 + 5^2}} = 14,1 \text{ Aeff}$$

$$P_{R2} = R_2 I_2^2 = 10 (14,1)^2 = 2000 \text{ W} \quad Q_{L2} = X_{L2} I_2^2 = 5 \cdot (14,1)^2 = 1000 \text{ VAR}$$

$$\text{quindi } A_{1+2} = \sqrt{(P_{R1} + P_{R2})^2 + (Q_{L1} + Q_{L2})^2} = 6263 \text{ VA}$$

$$\text{e ponotroaze } I_{AB} : I_{AB} = \frac{A_{1+2}}{V_1} = \frac{6263}{158} = 26,85 \text{ Aeff}$$

$$P_{R3} = R_3 I_{AB}^2 = 1 \cdot 26,85^2 = 721 \text{ W} \quad Q_{L3} = X_{L3} I_{AB}^2 = 2 \cdot (26,85)^2 = 1462 \text{ VAR}$$

$$Q_{AB} = Q_{L1} + Q_{L2} + Q_{L3} = 6662 \text{ VAR} \quad P_{AB} = P_{R1} + P_{R2} + P_{R3} = 3721 \text{ W}$$

$$A_{AB} = \sqrt{P_{AB}^2 + Q_{AB}^2} = 5796 \text{ VA} \quad \cos\varphi_{AB} = \frac{P_{AB}}{A_{AB}} = 0,64$$

$$V_{AB} = \frac{A_{AB}}{I_{AB}} = 215,79 \text{ Veff}$$

$$C = \frac{Q_{AB} - P_{AB} \tan(\arccos(0,9))}{2\pi f V_{AB}^2} = 180 \cdot \mu\text{F}$$