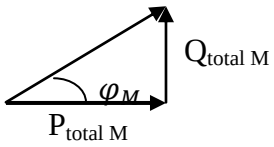
Solution TD N2 (puissance monophasé)

Exercice N1

Puissance active et réactive et apparente de l'installation

$\cos\varphi_M = 0.8 \triangleright\ \varphi_M = 36.87° \triangleright \sin\varphi_M = 0.6 \triangleright\ tg\varphi_M = 0.75$

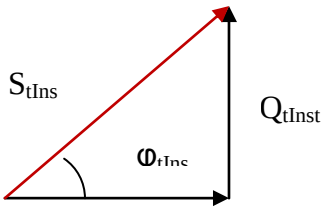
1-

Composants	Puissance Active P	Puissance Réactive Q
Lampes	$P_{total\ L}$=20*100=2KW	$Q_{total\ L}$= 0 VAR
Moteurs	$P_{total\ M}$ = 3*1.5= 4.5 KW	 $Q_{total\ M}$ = tg φ_M *$P_{total\ M}$ =4.5*0.75=3.37 KVAR
Installation	P_{tIns} = 2+4.5=6.5 KW	$Q_{t\ Ins}$ = 3.37 KVAR

$$S_{tInst} = \sqrt{P_{tIns}^2 + Q_{tInst}^2} = \sqrt{6.5^2 + 3.37^2} = 7.32\ KVA$$

2- **facteur de puissance**

$$cos\varphi_{tIns} = \frac{P_{tIns}}{S_{tIns}} = \frac{6.5}{7.32} = 0.89$$



3- **courant de ligne**

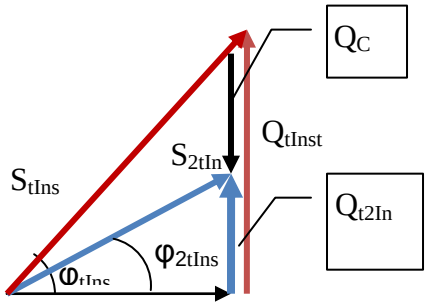
$$S_{tIns} = U \times I_{ins} \triangleright \quad I_{tIns} = \frac{S}{U} = \frac{7.32 \times 10^3}{230} = 31.78\ A$$

4- **Nouveau courant de ligne I_{2Ins}**

$$S_{tIns} = U \times I_{tins} = P_t \times cos\varphi_{tIns}$$
$$S_{2tIns} = U \times I_{2ins} = P_t \times cos\varphi_{2tIns}$$

$$\frac{U \times I_{tins}}{U \times I_{2ins}} = \frac{P_t \times cos\varphi_{tIns}}{P_t \times cos\varphi_{2tIns}}$$

$$I_{2ins} = \frac{I_{tins\times}}{cos\varphi_{tIns}}\ cos\varphi_{2tIns} = \frac{0.93\times31.78}{0.89} = 33.20\ A$$



Exercice N2

1- L'intensite du courant I_{Inst}

Composants	Puissance Active P	Puissance Réactive Q
moteur	$P_{total\ M}$=2 KW	$Q_{total\ M}$= tg φ$_M$ *$P_{total\ M}$ =2*0.88=1.76 KVAR
Radiateur	$P_{total\ R}$ = 3.0 KW	$Q_{total\ R}$ = 0KARV
Installation	P_{tIns} = 2+3=5 KW	$Q_{t\ Ins}$ = 1.76 KVAR

$$S_{tInst} = \sqrt{P_{tIns}^2 + Q_{tInst}^2} = \sqrt{5^2 + 1.76^2} = 5.30\ KVA$$

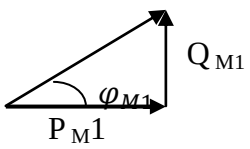
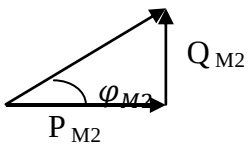
$$S_{tIns} = U \times I_{ins} \rhd \quad I_{tIns} = \frac{S}{U} = \frac{5.30 \times 10^3}{220} = 24\ A$$

2- Facteur de puissance de l'ensemble $cos\varphi_{Ins}$

$$cos\varphi_{tIns} = \frac{P_{tIns}}{S_{tIns}} = \frac{5}{5.3} = 0.94$$

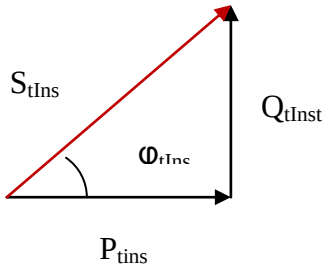
Exercice N3

1-Puissance active et réactive et apparente de l'installation

Composants	Puissance Active P	Puissance Réactive Q
Lampes	$P_{total\ L}$=20*100=2KW	$Q_{total\ L}$= 0 VAR
Moteur M1	P_{M1} = 800W	 Q_{M1} = tg φ$_{M1}$ *P_{M1} =800*0.75=600VAR
Moteur M2	P_{M2} = 1KW	 Q_{M2} = tg φ$_{M2}$ *P_{M2} =1000*0.485=480VAR
Installation	P_{tIns} = 2000+800+1000=3.8 KW	$Q_{t\ Ins}$ = 600+480= 1080VAR

$$S_{tInst} = \sqrt{P_{tIns}^2 + Q_{tInst}^2} = \sqrt{3.8^2 + 1.08^2} = 3.95\ KVA$$

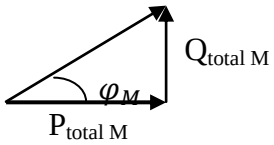
2- Facteur de puissance de l'ensemble $cos\varphi_{Ins}$



$$cos\varphi_{tIns} = \frac{P_{tIns}}{S_{tIns}} = \frac{3800}{3950} = 0.96$$

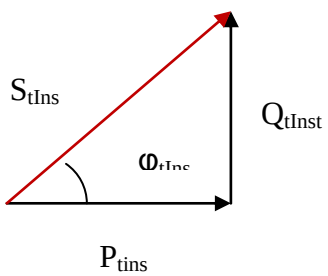
Exercice N4

1-Puissance active et réactive et apparente de l'installation

Composants	Puissance Active P	Puissance Réactive Q
Lampes	$P_{total\ L}$=30*100=3KW	$Q_{total\ L}$= 0 VAR
Moteurs	$P_{total\ M}$ = 2*2= 4 KW	 $Q_{total\ M}$ = tg φ_M *$P_{total\ M}$ =4*1.02=4080VAR
Installation	P_{tIns} = 3+4=7 KW	$Q_{t\ Ins}$ = 0+4080= 4.08 KVAR

$$S_{tInst} = \sqrt{P_{tIns}^2 + Q_{tInst}^2} = \sqrt{7^2 + 4.08^2} = 8.102\ KVA$$

2-Facteur de puissance de l'ensemble $cos\varphi_{Ins}$

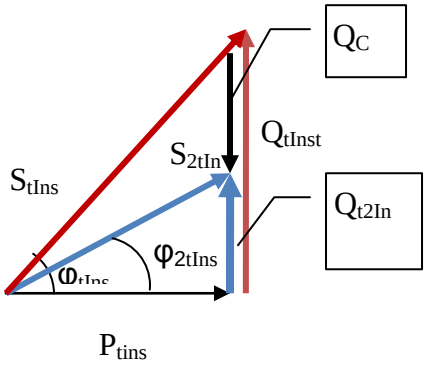


$$cos\varphi_{tIns} = \frac{P_{tIns}}{S_{tIns}} = \frac{7}{8.1020} = 0.86$$

3- courant de ligne

$$S_{tIns} = U \times I_{ins} \triangleright \quad I_{tIns} = \frac{S}{U} = \frac{8.102}{220} = 36.26\ A$$

4- capacité du condensateur



$cos\varphi_{tIns} = 0.86 \Rightarrow tg\varphi_{tIns} = 0.59$
$cos\varphi_{2t2ns} = 0.96 \Rightarrow tg\varphi_{tns} = 0.395$

$$Q_C = X_c \times I_{2Inst}^2 = X_c \times \left(\frac{U}{X_C}\right)^2 = \frac{U^2}{X_C}$$

$$X_c = \frac{1}{C\omega}$$

$$Q_C = \frac{U^2}{\frac{1}{C\omega}} = U^2 C\omega \Rightarrow C = \frac{Q_C}{U^2\omega} = \frac{Q_C}{U^2 \times 2 \times \pi \times f}$$

$$Q_C = Q_{tIns} - Q_{t2Ins} = \quad Q_{tInst} - P_{tIns} \times \tan\varphi_{2t2ns}$$

$= 4.08 - 7 \times 0.395 = 1.315$ KVAR

$$C = \frac{1.315}{220^2 \times 2 \times \pi \times 50} = \mathbf{8.65 * 10^{-5}}\ \text{F ou } \mathbf{0.865\ \mu F}$$