Nº 11.1.1

a) $Q = \sqrt{S^2 - P^2} = \sqrt{83^2 - 46^2} = \underline{69,08 \text{ var}}$

b) $Xc = \frac{U^2}{Q} = \frac{220^2}{69,08} = \underline{700,63\ \Omega}$

b) $C = \frac{1}{w \cdot Xc} = \frac{1000000}{314 \cdot 700,63} = \underline{4,54\ \mu F}$

Tang de $\cos\varphi$ 1 => 0,55 = 1,518

Tang de $\cos\varphi$ 2 => 0,95 = −0,328

Δtg $Tg1 - Tg2$ = 1,19

$\Delta Q = P \cdot \Delta tg = 46 \cdot 1,19 = \underline{54,74 \text{ var}}$

c) $Xc = \frac{U^2}{\Delta Q} = \frac{220^2}{54,74} = 884,18\ \Omega$

c) $C = \frac{1}{w \cdot Xc} = \frac{1000000}{314 \cdot 884,18} = \underline{3,6\ \mu F}$

Nº 11.1.2

$S = U \cdot I = 396\ VA$

a) $\cos\varphi = \frac{P}{S} = \frac{140}{396} = \underline{0,\overline{35}}$

b) $Q = \sqrt{S^2 - P^2} = \sqrt{396^2 - 140^2} = 370,42 \text{ var}$

tg de $\cos\varphi$ 1 => $0,\overline{35} = 2,646$

tg de $\cos\varphi$ 2 => 0,8 = −0,75

Δtg = 1,896

$\Delta Q = P \cdot \Delta tg = 140 \cdot 1,896 = \underline{256,44 \text{ var}}$

$Xc = \frac{U^2}{P} = \frac{220^2}{256,44} = 188,74\ \Omega$

c) $C = \frac{1}{w \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 188,74} = \underline{16,87\ \mu F}$

tg de $\cos\varphi$ 1 => $0,\overline{35} = 2,646$

tg de $\cos\varphi$ 2 => 0,9 = −0,484

Δtg = 2,162

$\Delta Q = P \cdot \Delta tg = 140 \cdot 2,162 = \underline{302,68 \text{ var}}$

11.1.2 Suite

$$Xc = \frac{U^2}{\Delta Q} = \frac{220^2}{302,68} = 159,9\ \Omega$$

d) $$C = \frac{1}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 159,9} = \underline{\underline{19,92\ \mu F}}$$

№ 11.1.3

$$\text{un groupe} = \frac{21}{3} = 7 \text{ lpes.}$$

$$S = U \cdot I \cdot W = 220 \cdot 2,04 \cdot 7 = 3141,6\ VA$$

$$P = P \cdot n = 256 \cdot 7 = 1792\ W$$

tg de cosφ 1 => 0,56 = 1,479

tg de cosφ 2 => 0,95 = − 0,3286

$$\Delta tg = 1,1508$$

$$\Delta Q = P \cdot \Delta tg = 1792 \cdot 1,1508 = 2062,32\ var$$

$$Xc = \frac{U^2}{-\Delta Q} = \frac{220^2}{2062,32} = 23,468\ \Omega$$

$$C = \frac{1 \cdot 10^6}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 23,46} = \underline{\underline{135,7\ \mu F}}$$

№ 11.1.4

$$P_1 = \frac{P}{N} = \frac{1500}{0,73} = 2054,8\ W$$

tg de cosφ_1 => 0,65 = 1,1691

tg de cosφ_2 => 0,91 = −0,4556

$$\Delta tg = 0,7135$$

$$S = \frac{P}{\cos\varphi} = \frac{2054,8}{0,65} = 3161,23\ VA$$

a) $$Q = \sqrt{S^2 - P^2} = \sqrt{3161,23^2 - 2054,8^2} = \underline{\underline{2402,32\ var}}$$

$$Q_2 = P \cdot tg\,2 = 2054,8 \cdot 0,4556 = \underline{\underline{936,16\ var}}$$

$$\Delta Q = P \cdot \Delta tg = 2054,8 \cdot 0,7135 = 1466,09\ var$$

$$Xc = \frac{U^2}{\Delta Q} = \frac{220^2}{1466,09} = 33,013\ \Omega$$

b) $$C = \frac{1 \cdot 10^6}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 33,013} = \underline{\underline{96,47\ \mu F}}$$

11.1.4 Suite

$S = \sqrt{P^2 + Q^2} = \sqrt{2054,8^2 + 936,16^2} = 2257,79\ VA$

c) $I_1 = \frac{S}{U} = \frac{361,23}{220} = \underline{\underline{14,37\ A}}$

$I_2 = \frac{S}{U} = \frac{2257,8}{220} = \underline{\underline{10,26\ A}}$

Nº 11.1.5

$S = \frac{P}{\cos\varphi} = \frac{170}{0,42} = 404,76\ VA$

a) $Q = \sqrt{S^2 - P^2} = \sqrt{404,76^2 - 170^2} = \underline{\underline{367,33\ var}}$

tg de $\cos\varphi_1 \Rightarrow 0,42 = 2,1607$

tg de $\cos\varphi_2 \Rightarrow 0,95 = -0,3286$

$\Delta tg = 1,8321$

$\Delta Q = P \cdot \Delta tg = 170 \cdot 1,8321 = 311,47\ var$

$Xc = \frac{U^2}{\Delta Q} = \frac{220^2}{311,47} = 155,4\ \Omega$

$C = \frac{1 \cdot 10^6}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 155,4} = \underline{\underline{20,5\ \mu F}}$

Nº 11.1.6

$P = U \cdot I \cdot \cos\varphi = 220 \cdot 14 \cdot 0,6 = 1848\ W$

tg de $\cos\varphi_1 \Rightarrow 0,6 = 1,333$

tg de $\cos\varphi_2 \Rightarrow 0,9 = -0,484$

$\Delta tg = 0,849$

$\Delta Q = P \cdot \Delta tg = 1848 \cdot 0,849 = 1568,97\ var$

$Xc = \frac{U^2}{\Delta Q} = \frac{220^2}{1568,97} = 30,848\ \Omega$

$C = \frac{1 \cdot 10^6}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 30,848} = \underline{\underline{103,23\ \mu F}}$

Nº 11.1.7

$S = U \cdot I = 220 \cdot 7,5 = 1650\ VA$

$Q = \sqrt{S^2 - P^2} = \sqrt{1650^2 - 1045^2} = 1276,9\ var$

11.1.7 Suite

a) $\cos \varphi = \frac{P}{S} = \frac{1045}{1650} = \underline{\underline{0,6\bar{3}}}$

$X_C = \frac{1}{\omega \cdot C} = \frac{1 \cdot 10^6}{314 \cdot 60} = 53,07\ \Omega$

$X_C = \frac{U^2}{\Delta Q} \Rightarrow \Delta Q = \frac{U^2}{X_C} = \frac{220^2}{53,07} = 912\ \text{var}$

$Q = Q_1 - \Delta Q = 1276,9 - 912 = 364,89\ \text{var}$

$S = \sqrt{P^2 + Q^2} = \sqrt{1045^2 + 364,89^2} = 1106,87\ \text{VA}$

$\cos \varphi = \frac{P}{S} = \frac{1045}{1106,87} = \underline{\underline{0,944}}$

Nº 11.2.1

$$S = \frac{P}{\cos\varphi} = \frac{22}{0,65} = 33,846 \text{ kVA}$$

a) $Q = \sqrt{S^2 - P^2} = \sqrt{33,846^2 - 22^2} = \underline{25,72 \text{ kvar}}$

tg de cos φ 1 => 0,65 = 1,169

tg de cos φ 2 => 0.8 = − 0,75

$\Delta tg = \underline{0,419}$

c) $\Delta Q = P \cdot \Delta tg = 22 \cdot 0,419 = \underline{9,22 \text{ kvar}}$

b) $Q_2 = Q_1 - \Delta Q = 25,72 - 9,22 = \underline{16,499 \text{ kvar}}$

d) $Q = \frac{Q}{3} = \frac{9,22}{3} = \underline{3,073 \text{ kvar}}$

Nº 11.2.2

a) $\cos\varphi = \frac{P}{S} = \frac{1300}{2000} = \underline{0,65}$

b) $Q = \sqrt{S^2 - P^2} = \sqrt{2000^2 - 1500^2} = \underline{1519,86 \text{ var}}$

tg de cos φ 1 => 0,65 = 1,169

tg de cos φ 2 => 0,85 = − 0,619

$\Delta tg = \underline{0,549}$

c) $\Delta Q = P \cdot \Delta tg = 1300 \cdot 0,549 = \underline{1519,8 \text{ var}}$

Nº 11.2.3

$$P_1 = \frac{P_2}{N} = \frac{120}{0,9} = 133,33 \text{ kW}$$

$$S = \frac{P_1}{\cos\varphi} = \frac{133,33}{0,8} = 166,66 \text{ kVA}$$

a) $Q = \sqrt{S^2 - P^2} = \sqrt{166,66^2 - 133,33^2} = \underline{100 \text{ kvar}}$

tg de cos φ 1 => 0,8 = 0,75

tg de cos φ 2 => 0,95 = 0,3286

$\Delta tg = \underline{0,4214}$

c) $\Delta Q = P \cdot \Delta tg = 133,33 \cdot 0,4214 = \underline{56,186 \text{ kvar}}$

a) $Q_2 = Q - \Delta Q = 100 - 56,186 = \underline{43,813 \text{ kvar}}$

11. 2. 3. Suite

b) $I_1 = \frac{P}{U \cdot \sqrt{3} \cdot \cos\varphi \cdot n} = \frac{120\,000}{380 \cdot 1{,}73 \cdot 0{,}8 \cdot 0{,}9} = \underline{253{,}23\ A}$

b) $I_2 = \frac{P}{U \cdot \sqrt{3} \cdot \cos\varphi \cdot n} = \frac{120000}{380 \cdot 1{,}73 \cdot 0{,}95 \cdot 0{,}9} = \underline{213{,}24\ A}$

$Xc = \frac{U^2}{\Delta Q} = \frac{380^2}{56186} = 2{,}57\ \Omega$

c) $C = \frac{1 \cdot 10^6}{\omega \cdot Xc} = \frac{1 \cdot 10^6}{314 \cdot 2{,}57} = \underline{1239\ \mu F}$

d) C par condensateur $= \frac{C}{n} = \frac{1239}{6} = \underline{206{,}5\ \mu F}$

N° 11.2.4

Cos φ de 55° = 0,5735

a) $S = U \cdot I \cdot \sqrt{3} = 380 \cdot 28 \cdot 1{,}73 = \underline{18{,}407\ kVA}$

$P = U \cdot I \cdot \sqrt{3} \cdot \cos\varphi = 380 \cdot 28 \cdot 1{,}73 \cdot 0{,}5735 = \underline{10{,}556\ kW}$

$Q = \sqrt{S^2 - P^2} = \sqrt{18{,}407^2 - 10{,}556^2} = \underline{15{,}079\ kvar}$

tg de cos φ 1 => 0,5735 = 1,428

tg de cos φ 2 => 0,8 − 0,75

$\Delta tg = 0{,}678$

c) $\Delta Q = P \cdot \Delta tg = 10{,}556 \cdot 0{,}678 = \underline{7{,}161\ kvar}$

b) $Q = Q_1 - \Delta Q = 15{,}079 - 7{,}161 = \underline{7{,}917\ kvar}$

$P = \underline{10{,}556\ kW}$ (ne change pas)

$S = \sqrt{P^2 + Q^2} = \sqrt{10{,}556^2 + 7{,}917^2} = \underline{13{,}195\ kVA}$

d) $I = \frac{P}{U \cdot \sqrt{3} \cdot \cos\varphi} = \frac{10556}{380 \cdot 1{,}73 \cdot 0{,}1} = \underline{20{,}5\ A}$

e) $I = \frac{\Delta Q}{U \cdot \sqrt{3} \cdot \cos\varphi} = \frac{7161}{380 \cdot 1{,}73 \cdot 1} = \underline{10{,}83\ A}$

N° 11.2.5

$P = \frac{W}{t} = \frac{2772}{21 \cdot 8{,}25} = 16\ kW$

tg de cos φ 1 => 0,43 = 2,099

tog de cos φ2 => 0,85 = 0,6197

$\Delta tg = 1{,}479$

$\Delta Q = P \cdot \Delta tg = 16 \cdot 1{,}479 = \underline{23{,}678\ kvar}$

Nº 11.2.6

tg de $\cos\varphi$ 1 => 0,3 = 3,179

tg de $\cos\varphi$ 2 => 0,82 = 0,698

Δtg = 2,481

a) $\Delta Q = P \cdot \Delta tg = 350 \cdot 2,481 = \underline{868,6 \text{ var}}$

b) $I = \frac{P}{U \cdot \sqrt{3} \cdot \cos\varphi} = \frac{350}{220 \cdot 1,73 \cdot 0,3} = \underline{3,061 \text{ A}}$

$S = \frac{P}{\cos\varphi} = \frac{350}{0,82} = 426,8 \text{ VA}$

b) $I_2 = \frac{S}{U \cdot \sqrt{3}} = \frac{426,8}{220 \cdot 1,73} = \underline{1,12 \text{ A}}$

c) $I \text{ condo} = \frac{\Delta Q}{U \cdot \sqrt{3}} = \frac{868,6}{220 \cdot 1,73} = \underline{2,279 \text{ A}}$

Nº 11.2.7

$P = \frac{W}{t} = \frac{15200}{40 \cdot 8} = 47,5 \text{ kW}$

$Q = \frac{W}{t} = \frac{17600}{40 \cdot 8} = 55 \text{ kvar}$

$S = \sqrt{P^2 + Q^2} = \sqrt{47,5^2 + 55^2} = 72,67 \text{ VA}$

$\cos\varphi = \frac{P}{S} = \frac{47,5}{72,67} = 0,653$

tg de $\cos\varphi$ 1 => 0653 = 1,159

tg de $\cos\varphi$ 2 => 0,7 = 0,75

$\Delta tg = 0,409$

a) $\Delta Q = P \cdot \Delta tg = 47,5 \cdot 0,409 = \underline{19,466 \text{ kvar}}$

$Q = Q_1 - \Delta Q = 55 - 19,466 = 35,53 \text{ kvar}$

b) $W = Q \cdot t = 35,53 \cdot 40 \cdot 8 = \underline{11,37 \text{ kvar}}$

Nº 11.2.8

$S = \sqrt{P^2 + Q^2} = \sqrt{28^2 + 37^2} = 46,4 \text{ kVA}$

a) $\cos\varphi = \frac{P}{S} = \frac{28}{46,4} = \underline{0,603}$

c) $Q = Q_1 - \Delta Q = 37 - 15 = \underline{22 \text{ kvar}}$

11. 2. 8. Suite

Nelle $S = \sqrt{P^2 + Q^2} = \sqrt{28^2 + 22^2} = 35,6$ kVA

b) $\cos \varphi 2 = \frac{P}{\text{Nelle } S} = \frac{28}{35,6} = \underline{\underline{0,786}}$

Nº 11. 2. 9

tg de cos φ 1 => 0,5 = 1,732

" 2 => 0,6 = 1,333

" 3 => 0,7 = 1,02

" 4 => 0,8 = 0,75

" 5 => 0,9 = 0,484

" 6 => 1 = 0

$\Delta tg\ 1 = tg\ 1 - tg\ 2 = 1,732 - 1,33 = 0,398$

$\Delta tg\ 2 = tg\ 1 - tg\ 3 = 1,732 - 1,02 = 0,712$

$\Delta tg\ 3 = tg\ 1 - tg\ 4 = 1,732 - 0,75 = 0,892$

$\Delta tg\ 4 = tg\ 1 - tg\ 5 = 1,732 - 0,484 = 1,248$

$\Delta tg\ 5 = tg\ 1 - tg\ 6 = 1,732 - 0 = 1,732$

$P = S \cdot \cos \varphi = 4000 \cdot 0,5 = 2000$ VA

a) $\Delta Q = P \cdot \Delta tg\ 1 = 2000 \cdot 0,389 = \underline{\underline{796 \text{ var}}}$

" $2 = 2000 \cdot 0,712 = \underline{\underline{1424 \text{ var}}}$

" $3 = 2000 \cdot 0,892 = \underline{\underline{1784 \text{ var}}}$

" $4 = 2000 \cdot 1,248 = \underline{\underline{2498 \text{ var}}}$

" $5 = 2000 \cdot 1,732 = \underline{\underline{3464 \text{ var}}}$

$Xc = \frac{U^2}{\Delta Q} = \frac{380^2}{796} = 181,4\ \Omega$

b) $C = \frac{\frac{1 \cdot 10^6}{\omega \cdot xc}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 181,4}}{3} = \underline{\underline{5,85\ \mu F}}$

$Xc = \frac{U^2}{\Delta Q} = \frac{380^2}{1424} = 101,4\ \Omega$

$C = \frac{\frac{1 \cdot 10^6}{\omega \cdot Xc}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 101,4}}{3} = \underline{\underline{10,47\ \mu F}}$

11.2.9 Suite

b) $X_C = \frac{U^2}{\Delta Q} = \frac{380^2}{1784} = 80{,}94\ \Omega$

$$C = \frac{\frac{1 \cdot 10^6}{\omega \cdot c}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 80{,}94}}{3} = 13{,}11\ \mu F$$

$X_e = \frac{U^2}{\Delta Q} = \frac{380^2}{2498} = 57{,}8\ \Omega$

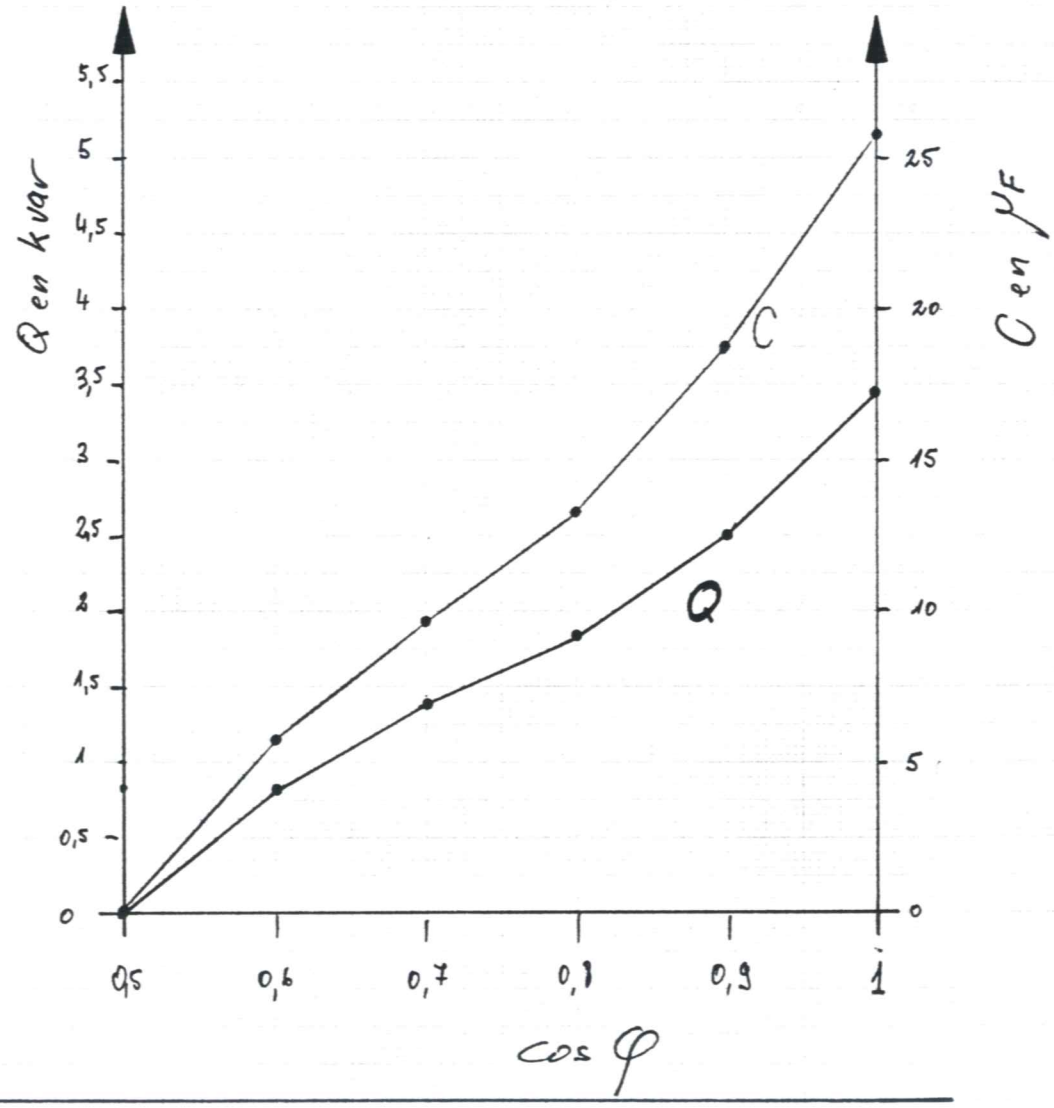
$$c = \frac{\frac{1 \cdot 10^6}{\omega \cdot X_e}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 57{,}8}}{3} = 18{,}36\ \mu F$$

$X_e = \frac{U^2}{\Delta Q} = \frac{380^2}{3464} = 41{,}685\ \Omega$

$$c = \frac{\frac{1 \cdot 10^6}{\omega \cdot X_e}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 41{,}685}}{3} = 25{,}46\ \mu F$$

Courbes :

c)



N° 11.2.10

$$S = \frac{P}{\cos\varphi} = \frac{130}{0,76} = 171,05 \text{ kVA}$$

$$Q = (\text{ne change pas !}) = \sqrt{S^2 - P^2} = \sqrt{171,05^2 - 130^2} = 111,17 \text{ kvar}$$

$$N^{elle}\ P = P_1 + P_2 = 130 + 50 = 180 \text{ kW}$$

$$N^{elle}\ S = \sqrt{P^2 + Q^2} = \sqrt{180^2 + 111,17^2} = 211,56 \text{ kVA}$$

$$\cos\varphi = \frac{N^{elle} P}{N^{elle} S} = \frac{180}{211,56} = \underline{\underline{0,851}}$$

N° 11.2.11

$$P = P \cdot n \cdot 3 = 46 \cdot 16 \cdot 3 = 2208 \text{ W}$$

$$S = \frac{P}{\cos\varphi} = \frac{2208}{0,53} = 4166 \text{ VA}$$

tg de $\cos\varphi 1 \Rightarrow 0,53 = 1,599$

tg de $\cos\varphi 2 \Rightarrow 0,95 = 0,3286$

$$\Delta tg = 1,271$$

a) $$\Delta Q = P \cdot \Delta tg = 2208 \cdot 1,271 = \underline{\underline{2806 \text{ var}}}$$

$$Xc = \frac{U^2}{\Delta Q} = \frac{380^2}{2806} = 51,46 \ \Omega$$

b) $$C = \frac{\frac{1 \cdot 10^6}{\omega \cdot Xc}}{3} = \frac{\frac{1 \cdot 10^6}{314 \cdot 51,46}}{3} = \underline{\underline{20,52 \ \mu F}}$$

N° 11.2.12

$$P = \frac{W}{t} = \frac{160}{1} = 20 \text{ kW}$$

$$Q = \frac{W}{t} = \frac{216}{1} = 27 \text{ kvar}$$

$$S = \frac{P}{\cos\varphi} = \frac{20}{0,8} = 25 \text{ kVA}$$

$$Q \text{ max} = \sqrt{S^2 - P^2} = \sqrt{25^2 - 20^2} = 15 \text{ kvar}$$

$$\Delta Q = Q_1 - Q = 27 - 15 = \underline{\underline{12 \text{ kvar}}}$$
