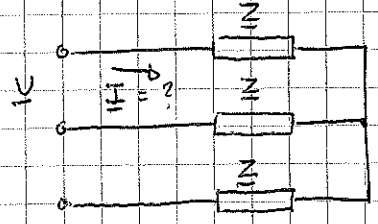
$\underline{Z} = 12 + j6 \ \Omega$; $U = 380$ V;

a)

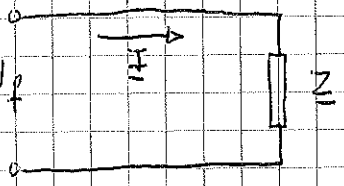


linjeström = fasström

$\underline{Z} = 12 + j6 = 13{,}42 \angle 26{,}57^\circ \ \Omega/\text{fas}$

$R + jX$

Ekvivalent Y-fas



$\underline{U}_f = \frac{\underline{U}}{\sqrt{3}} = \frac{380}{\sqrt{3}} = 220$ V

$\underline{I} = \frac{\underline{U}_f}{\underline{Z}} = \frac{220\angle 0^\circ}{13{,}42\angle 26{,}57^\circ} = 16{,}4\angle -26{,}57^\circ$ A

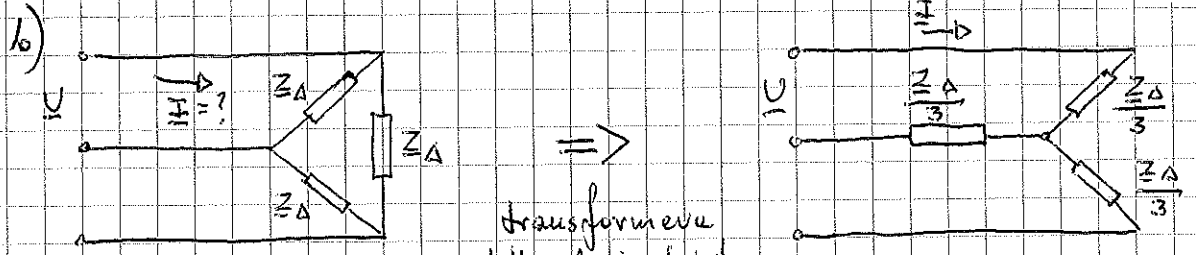
$P = 3 U_f I \cos\varphi = 3 \cdot 220 \cdot 16{,}4 \cdot \cos 26{,}57^\circ = 9681$ W $= 9{,}68$ kW

alt $P = 3 R I^2 = 3 \cdot 12 \cdot (16{,}4)^2 = 9{,}68$ kW

$Q = 3 U_f I \sin\varphi = 3 \cdot 220 \cdot 16{,}4 \cdot \sin 26{,}57 = 4841$ VAr $= 4{,}84$ kVAr

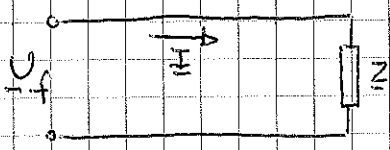
alt $Q = 3 X I^2 = 3 \cdot 6 \cdot (16{,}4)^2 = 4{,}84$ kVAr

b)



$\underline{Z}_\Delta = 12 + j6 \ \Omega \Rightarrow \frac{\underline{Z}_\Delta}{3} = 4 + j2 = 4{,}47\angle 26{,}57^\circ \ \Omega/\text{fas}$

Ekv. Y-fas



$\underline{I} = \frac{220\angle 0^\circ}{4{,}47\angle 26{,}57^\circ} = 49{,}2\angle -26{,}57^\circ$ A

(x3) $P = 3 U_f I \cos\varphi = 3 \cdot 220 \cdot 49{,}2 \cdot \cos 26{,}57^\circ = 29053$ W $= 29{,}05$ kW

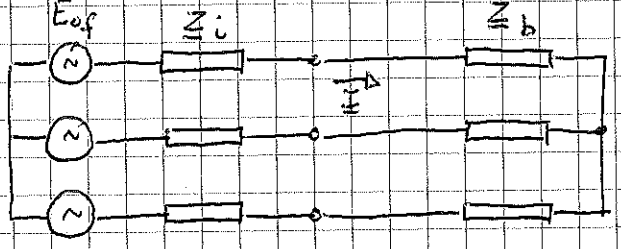
$Q = \sqrt{3} U I \sin\varphi = \sqrt{3} \cdot 380 \cdot 49{,}2 \sin 26{,}57^\circ = 14484$ VAr $= 14{,}48$ kVAr

2.2 *

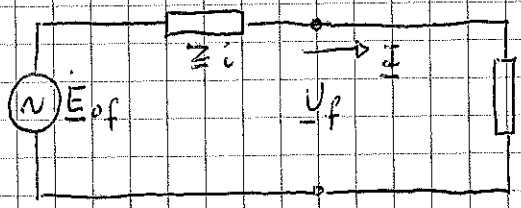
$E_o = 500\ V$; $\underline{Z}_i = 0,5 + j3\ \Omega/fas$

Belastning: $\cos\varphi = 0,8$ ind ; $Z_b = 9\ \Omega/fas$

a) $\underline{I} = ?$



Ekv. Y-fas:



$\underline{E}_{of} = \frac{E_o}{\sqrt{3}}\angle 0^\circ$ V referens

$\underline{Z}_i = 0,5 + j3 = 3,04\angle 80,54^\circ\ \Omega/fas$

$\cos\varphi = 0,8 \Rightarrow \varphi = 36,87^\circ$ ind

$\underline{Z}_b = 9\angle 36,87^\circ\ \Omega/fas = 7,2 + j5,4\ \Omega/fas$

$$\underline{I} = \frac{\underline{E}_{of}}{\underline{Z}_i + \underline{Z}_b} = \frac{500/\sqrt{3}\angle 0^\circ}{0,5 + j3 + 7,2 + j5,4} = \frac{500\sqrt{3}\angle 0^\circ}{11,4\angle 47,5^\circ} = 25,3\angle -47,5^\circ\ A$$

47,49°

b) $\underline{U}_f = \underline{Z}_b \underline{I} = 9\angle 36,87^\circ \cdot 25,3\angle -47,5^\circ = 227,7\angle -10,6^\circ$ V

47,49 −10,62°

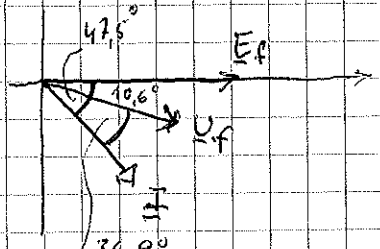
$U = \sqrt{3} \cdot 227,7 = 394,4$ V

c) $\underline{S}_f = \underline{U}_f \underline{I}^* = 227,7\angle -10,6^\circ \cdot 25,3\angle 47,5^\circ = 5761\angle 36,9^\circ$ VA

5760,8

$\underline{S} = 3\underline{S}_f = 17282\angle 36,9^\circ = (13826 + j10369)$ VA

$\downarrow P$ (W) $\quad \downarrow Q$ (VAr)

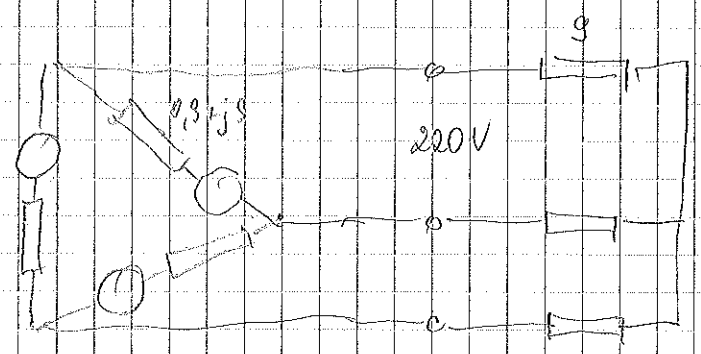


14781,8
14805

d) $P_g = 3R_i I^2 = 3 \cdot 0,5 \cdot (25,3)^2 = 960$ W

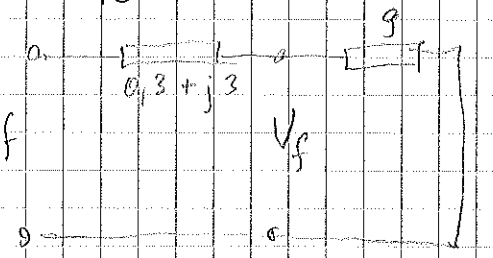
960,8

2.3



$$I = \frac{220}{\sqrt{3}\cdot 9} = 14,11\,A$$

$$I_\Delta = \frac{14,4}{\sqrt{3}} = 8,15\,A$$



$$E_{af} = V_f + (0,3+j3)\cdot 14,11\angle 0$$

$$= 127 + 4,23 + j\,42,33$$

$$= 131,23 + j\,42,33 = 137,9\,V\angle 17,88^\circ$$

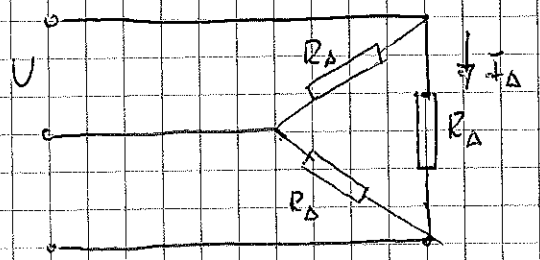
$$E_0 = 238,85\,V$$

2.4

$U = 400\ V$; $P = 10\ kW$;

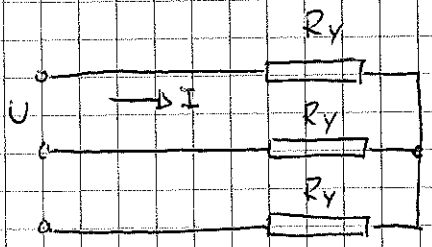
Last - 3 lika motstånd (resistorer)

a) $R_\Delta = ?$; $R_Y = ?$



$$P = 3 R_\Delta I_\Delta^2 = 3 R_\Delta \left(\frac{U}{R_\Delta}\right)^2 = 3 \frac{U^2}{R_\Delta}$$

$$\Rightarrow \underline{\underline{R_\Delta = 3 \frac{U^2}{P} = 3 \frac{400^2}{10 \cdot 10^3} = 48\ \Omega}}$$

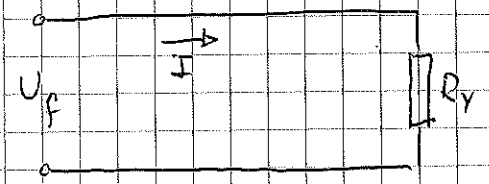


$$P = 3 R_Y I^2 = 3 R_Y \left(\frac{U}{\sqrt{3} R_Y}\right)^2 = \frac{U^2}{R_Y}$$

$$\Rightarrow \underline{\underline{R_Y = \frac{U^2}{P} = \frac{R_\Delta}{3} = 16\ \Omega}}$$

alt:

Ekv Y-fas



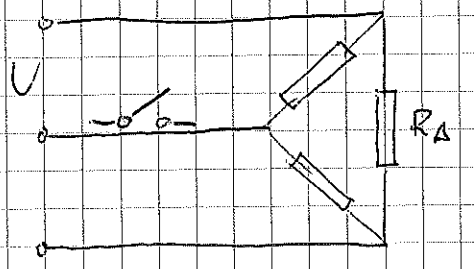
$$R_Y = \frac{U_f}{I} = \frac{U_f^2}{P_f} = \frac{\left(\frac{400}{\sqrt{3}}\right)^2}{\frac{10 \cdot 10^3}{3}} = 16\ \Omega$$

$$P_f = U_f I = \frac{P}{3}$$

$$R_\Delta = 3 R_Y = 48\ \Omega$$

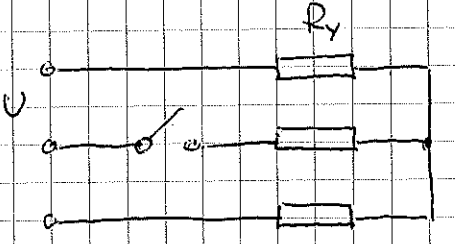
2.4

b) $P = ?$



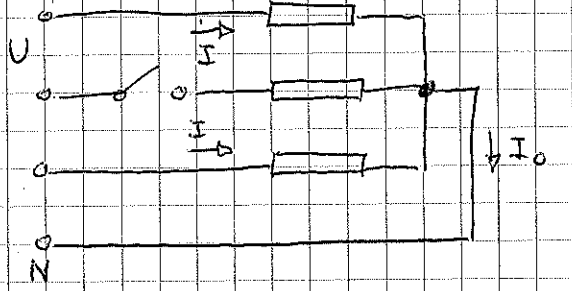
$$P_\Delta = \frac{U^2}{R_{ekv}} = \frac{U^2}{\frac{R_\Delta \cdot 2R_\Delta}{3R_\Delta}} = \frac{U^2}{\frac{2}{3}R_\Delta} =$$

$$= \frac{400^2}{\frac{2}{3}\cdot 48} = \underline{5000\ W}$$



$$P_Y = \frac{U^2}{R_{ekv}} = \frac{U^2}{2R_Y} = \frac{400^2}{2\cdot 16} = \underline{5000\ W}$$

med nollan:



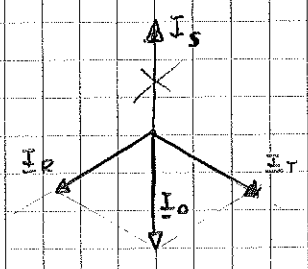
$$P_{Y0} = 2 \cdot \frac{U_f^2}{R_Y} = 2\,\frac{\left(\frac{400}{\sqrt{3}}\right)^2}{16} = \underline{6666{,}7\ W}$$

Extra! Hur stor är I_0?

$$I = \frac{U_f}{R_Y} = \frac{400}{\sqrt{3}\cdot 16} = 14{,}43\ A$$

OBS! $\underline{I}_0 = \underline{I}_R + \underline{I}_T \Rightarrow |I_0| = 14{,}43\ A$

vilka:

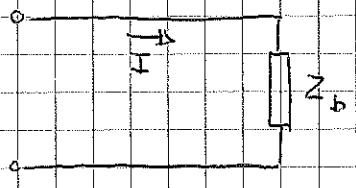


2.5

$U = 3,2\ kV$ $\quad P = 90\ kW$ $\quad \cos\varphi = 0,85$

2.5

Ekv Y - fas :



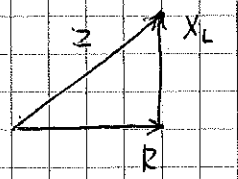
$P = \sqrt{3} \cdot U \cdot I \cos\varphi \Rightarrow$

$$I = \frac{P}{\sqrt{3} V \cos\varphi} = \frac{90 \cdot 10^3}{\sqrt{3} \cdot 3,2 \cdot 10^3 \cdot 0,85} = \underline{19,1\ A}$$

$$Z = \frac{U_f}{I} = \frac{3,2 \cdot 10^3}{\sqrt{3} \cdot 19,1} = 96,7\ \Omega/fas$$

$R = Z \cos\varphi = 82,2\ \Omega/fas$

$X_L = Z \sin\varphi = 50,9\ \Omega/fas$



$\underline{Z} = 82,2 + j\,50,9\ \Omega/fas$

2.6

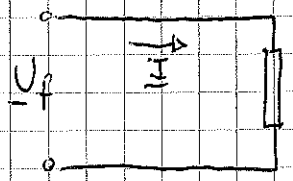
2.6

$U = 220$ V

$\underline{Z} = R + jX = 6 + j8 = 10 \angle 53{,}13^\circ$ Ω/fas

a) Y - kopplad last

Ekv Y-fas



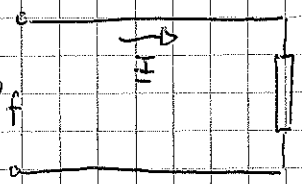
$$\underline{I} = \frac{\underline{U}_f}{\underline{Z}} = \frac{220/\sqrt{3} \angle 0^\circ}{10 \angle 53{,}13^\circ} = 12{,}7 \angle -53{,}13^\circ \text{ A}$$

$$P = 3RI^2 = 3 \cdot 6 \cdot (12{,}7)^2 = 2{,}9 \text{ kW}$$

$\cos 53{,}13^\circ \Rightarrow \cos\varphi = 0{,}6$

b) Δ - kopplad last

Ekv Y-fas



$$\underline{Z} = \frac{6 + j8}{3} = 2 + j2{,}67 = 3{,}33 \angle 53{,}13^\circ \text{ Ω/fas}$$

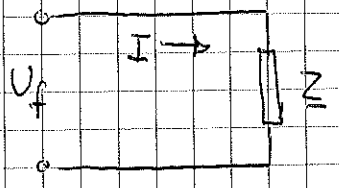
$$\underline{I} = 3 \cdot 12{,}7 \angle -53{,}13^\circ = 38{,}1 \angle -53{,}13^\circ \text{ A}$$

$$P = 3 \cdot 2 \cdot (38{,}1)^2 = 8{,}7 \text{ kW}$$

$\cos\varphi = 0{,}6$

2.7 $U_f = 127\,V$; $I = 40\,A$; $P = 12\,kW$ 2.7

Ekv Y-fas:



$P = 3U_f I \cos\varphi \Rightarrow$

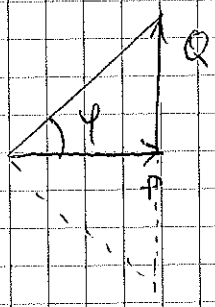
$$\Rightarrow \cos\varphi = \frac{P}{3U_f I} = \frac{12000}{3 \cdot 127 \cdot 40} = \underline{0{,}787}$$

$\varphi = \pm 38{,}06°$ ind eller kap last

$U = \sqrt{3} \cdot 127 = \underline{220\,V}$

$P = 3RI^2 \Rightarrow R = \frac{P}{3I^2} = \frac{12000}{3 \cdot 40^2} = 2{,}5\ \Omega/fas$

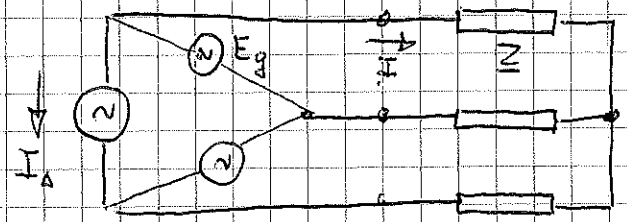
$Q = P \operatorname{tg}\varphi = 12000 \cdot \operatorname{tg} \pm 38{,}06° = \pm 9396\ VAr$



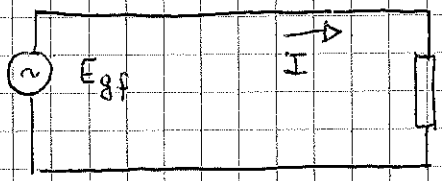
$$X = \frac{Q}{3I^2} = \frac{9396}{3 \cdot 40^2} = 1{,}96\ \Omega/fas$$

$\underline{Z = 2{,}5 \pm j\,1{,}96}\ \Omega/fas$

2.8 $I_\Delta = 40\,A$; $\underline{Z} = 6 + j4$ Ω/fas 2.8



Ekv Y-fas:



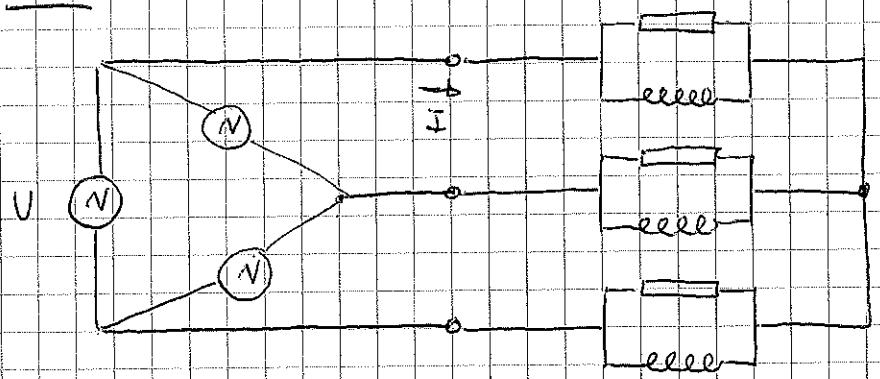
$$I = \sqrt{3}\, I_\Delta = \sqrt{3} \cdot 40 = \underline{69{,}3\ A}$$

$$U_f = Z I = 7{,}2 \cdot 69{,}3 = \underline{499\ V}$$

$$P = 3 R I^2 = 3 \cdot 6 \cdot (69{,}3)^2 = \underline{86{,}44\ kW}$$

$$Q = 3 X I^2 = 3 \cdot 4 \cdot (69{,}3)^2 = \underline{57{,}63\ kVAr}$$

2.9



2.9

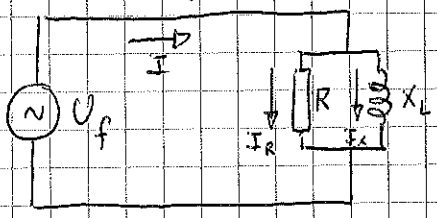
$U = 500\ V$

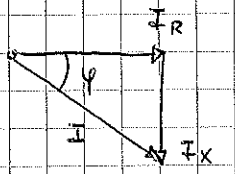
$I = 30\ A$

$\cos\varphi = 0{,}8$

$\varphi = 36{,}87°$

Ekv. Y-fas:





$$P = 3 U_f I \cos\varphi = 3 \frac{500}{\sqrt{3}} \cdot 30 \cdot 0{,}8 = 20{,}79\ kW$$

$$I_R = I \cos\varphi = 30 \cdot 0{,}8 = 24\ A$$

$$I_X = I \sin\varphi = 30 \cdot 0{,}6 = 18\ A$$

$$P = 3 R I_R^2 \Rightarrow R = \frac{20786}{3 (24)^2} = 12\ \Omega/fas$$

$$Q = 3 U_f I \sin\varphi = 3 \frac{500}{\sqrt{3}} \cdot 30 \cdot 0{,}6 = 15{,}59\ kVAr$$

$$Q = 3 X_L I_X^2 \Rightarrow X_L = \frac{Q}{3 (I_X)^2} = 16\ \Omega/fas$$

alt $P = 3 \frac{U_f^2}{R}$

$S = P + jQ$

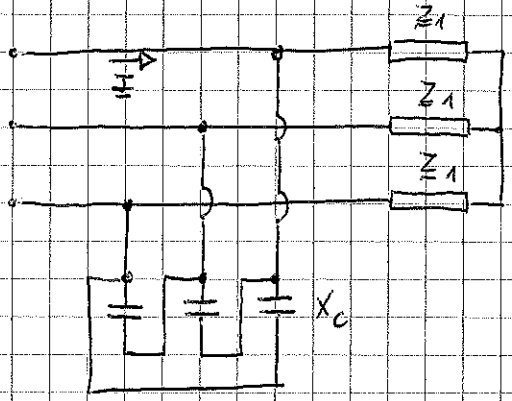
$Q = 3 \frac{U_f^2}{X_L}$

2.10

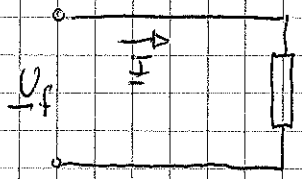
2.10

$\underline{Z}_1 = (15 + j\,9)\ \Omega/\text{fas} - Y$; $U = 380\,V$

$X_c = 100\ \Omega - \Delta$



a) Ekv. Y-fas:



$\underline{Z} = 15 + j\,9 = 17{,}5\angle 30{,}96^\circ\ \Omega/\text{fas}$

$$\underline{I} = \frac{\underline{U}_f}{\underline{Z}} = \frac{380/\sqrt{3}\ \angle 0^\circ}{17{,}5\angle 30{,}96^\circ} = \underline{12{,}54\angle -30{,}96^\circ\ A}$$

$\cos 30{,}96^\circ = 0{,}86$ ind

b)

$X_c = 100\ \Omega$

$X_{cy} = \frac{1}{3}100 = 33{,}3\ \Omega/\text{fas}$

$$\underline{Z}_{tot} = \underline{Z} /\!/ -jX_{cy} = \frac{(15+j9)(-j\,33{,}3)}{15+j\,3-j\,33{,}3} = \frac{299{,}7 - j\,499{,}5}{15 - j\,24{,}3} =$$

$$= \frac{582{,}5\angle -59{,}0^\circ}{28{,}6\angle -58{,}40} = 20{,}4\angle \sim 0^\circ\ \Omega/\text{fas}$$

$$\underline{I} = \frac{\underline{U}_f}{\underline{Z}_{tot}} = \frac{220\angle 0^\circ}{20{,}4\angle 0^\circ} = \underline{10{,}78\angle 0^\circ\ A}$$

I; fas med U_f

förklara fasvinkel

alt: $P = 3U_f I\cos\varphi$

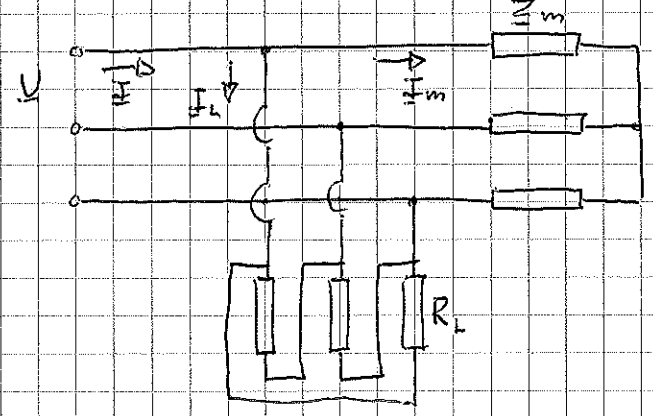
$Q = 3U_f I\sin\varphi$

$Q_c = 3\frac{U^2}{X_c}$

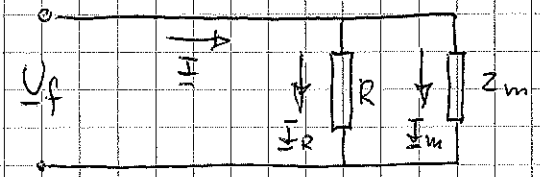
$Q_{res} = Q_L - Q_c \sim 0\ VAr$

2.11 $U = 220\,V$; Lampor - Δ - $3\,kW = P_L$ 2.11

Motor - Y - $10\,kW = P_m$; $\cos\varphi = 0{,}8$



Ekv Y - fas:



Motor:

$$P = 3\,U_f\,I_m\cos\varphi \Rightarrow I_m = \frac{10\cdot 10^3}{3\cdot\frac{220}{\sqrt{3}}\cdot 0{,}8} = 32{,}8\,A$$

$$\underline{I}_m = 32{,}8\,(0{,}8 - j\,0{,}6) = (26{,}24 - j\,19{,}7)\ A$$

Lampor:

$$I_L = \frac{3\cdot 10^3}{3\cdot\frac{220}{\sqrt{3}}} = 7{,}87\,A = \underline{I}_L$$

$$\underline{I} = \underline{I}_L + \underline{I}_m = 7{,}87 + 26{,}24 - j\,19{,}7 = 34{,}11 - j\,19{,}7 = \underline{39{,}4\angle -30^\circ\ A}$$

$$\underline{\cos\varphi = 0{,}866}$$

Alt visa!

P	Q
10	7,5
3	0
13	7,5

$\Rightarrow S = 15{,}0\,kVA \Rightarrow I = \frac{S}{\sqrt{3}\,U} = 39{,}4\,A$

$\operatorname{tg}\varphi = \frac{7{,}5}{13} \Rightarrow \cos\varphi = 0{,}866$

2.12

$U = 500\ V$

Tvåwattmetermetoden

$P_1 = 0\ W \qquad I = 15\ A$

$\cos\varphi = ? \; ; \quad P_2 = ?$

1. $P_1 = U_{12} I_1 \cos\varphi' \; ; \quad P_2 = U_{32} I_3 \cos\varphi''$

$P_1 = 0 = U_{12} I_1 \cos\varphi' \Rightarrow \cos\varphi' = 0$

$\varphi + 30^\circ = \pm 90^\circ$

$\varphi = 60^\circ \qquad (-120^\circ$ ovimlight)

$\underline{\cos\varphi = 0{,}5}$

$P_2 = U_{32} I_3 \cos(\varphi - 30) = 500 \cdot 15 \cdot \cos 30 = \underline{6495\ W}$

2. $P_2 = 0\ W = U_{32} I_3 \cos\varphi'' \Rightarrow \varphi'' = \pm 90^\circ \rightarrow \varphi - 30 = \pm 90^\circ$

$\varphi = -60^\circ$

$\Rightarrow \varphi' = -60^\circ + 30^\circ = -30^\circ$

$P_1 = 500 \cdot 15 \cdot \cos(-30^\circ) = \underline{6495\ W}$

$\underline{\cos(-60^\circ) = 0{,}5}$

φ - pos $\rightarrow$ ind

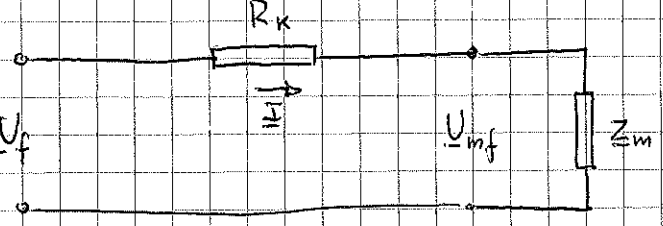
φ - neg $\rightarrow$ kap

2.12

2.13

2.13

Ekv Y-fas



$U_m = 365\ V$

$P = 8,1\ kW$

$I = 16\ A$

$1\,\Omega m = 10^6\ \frac{\Omega mm^2}{m}$

$1\,\mu\Omega m = 1\ \frac{mm^2}{m}\ \Omega$

$$R_k = \rho \frac{\ell}{A} = 0,017\ \frac{80}{2,5} = 0,54\ \Omega/fas$$

$$P = \sqrt{3}\, U_m I \cos\varphi \Rightarrow \cos\varphi = \frac{P}{\sqrt{3}\, U_m I} = \frac{8100}{\sqrt{3}\cdot 365\cdot 16} = 0,8$$

$$\underline{I} = 16\,(0,8 - j\,0,6) = 12,8 - j\,9,6 = 16\,\angle -36,87^\circ\ A$$

$$\underline{Z}_m = \frac{\underline{U}_{mf}}{\underline{I}} = \frac{365/\sqrt{3}\ \angle 0^\circ}{16\ \angle -36,87^\circ} = 13,17\ \angle 36,87^\circ = (10,54 + j\,7,9)\ \Omega/fas$$

$$\underline{Z}_{tot} = R_k + \underline{Z}_m = (11,08 + j\,7,9)\ \Omega/fas = 13,6\ \angle 35,5^\circ\ \Omega/fas$$

$$\underline{U}_f = \underline{Z}_{tot}\cdot \underline{I} = 13,6\ \angle 35,5^\circ \cdot 16\ \angle -36,87^\circ = 217,6\ \angle -1,37^\circ\ V$$

$$U = \sqrt{3}\, U_f = 377\ V$$

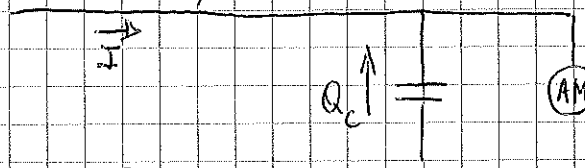
2.14 AM

$U = 400\,V$; $f = 50\,Hz$

$P_{2m} = 7\,kW$; $\cos\varphi = 0{,}8$; $\eta = 87{,}5\,\%$

Kond.bat. $Q_c = 4\,kVAr$

a)



$$\eta = \frac{P_{2m}}{P_{1m}} \Rightarrow P_{1m} = \frac{P_{2m}}{\eta} = \frac{7}{0{,}875} = 8\,kW \quad \text{(AM-förbrukar 8kW)}$$

$$Q_m = P_{1m} \tan\varphi = 8 \cdot 0{,}75 = 6\,kVAr$$

$$P_n = P_{1m}$$

$$Q_n = Q_m - Q_c = \underline{2\,kVAr}$$

$$\tan\varphi_n = \frac{Q_n}{P_n} = \frac{2}{8} = 0{,}25 \Rightarrow \cos\varphi_n = 0{,}97$$

$$I = \frac{P_n}{\sqrt{3} \cdot U \cos\varphi_n} = \frac{8000}{\sqrt{3} \cdot 400 \cdot 0{,}97} = 11{,}9\,A$$

b)

Allmänt $Q_c = 3\frac{U_c^2}{X_c} = 3\omega C U_c^2$ $\quad 3 U_{cf} I \sin\varphi$

Y-koppling

$U_c = \frac{400}{\sqrt{3}}\,V$ $\quad C_Y = \frac{Q_c}{3\omega U_c^2} = \frac{4000}{2\pi 50 \cdot 400^2} = 79{,}6\,\mu F$

Δ-koppling

$U_c = 400\,V$ $\quad C_\Delta = \frac{Q_c}{3\omega U_c^2} = \frac{4000}{3 \cdot 2\pi 50 \cdot 400^2} = 26{,}5\,\mu F$

(x 3)

2.15

$U = 400\ V$; $f = 50\ Hz$

Före:

$P_i = 140\ kW$; $\cos\varphi_i = 0,707$

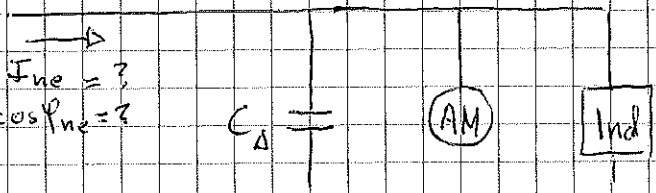
$\varphi_i = 45°$

$Q_i = P_i \tan\varphi_i = 140\ kVAr$

$S_i = \sqrt{2} \cdot 140\ kVA \Rightarrow I_{nf} = \dfrac{S_i}{\sqrt{3}\,U} = \dfrac{\sqrt{2} \cdot 140 \cdot 10^3}{\sqrt{3} \cdot 400} = 285,5\ A$

$\underline{I}_{nf} = 285,5 \angle -45°\ A$

Efter:



$C_\Delta = 1\ mF$

$P_m = 15\ kW$; $P_i = 140\ kW$

$I_m = 28,5\ A$; $Q_i = 140\ kVAr$

AM
$$\begin{cases} S_m = \sqrt{3} \cdot 400\ 28,5 = 19745\ VA \\ Q_m = \sqrt{S_m^2 - P_m^2} = \sqrt{19745^2 - 15000^2} = 12840\ VAr \end{cases}$$

Δ-kopplad kond

$U_c = 400\ V$; $Q_c = 3\omega C_\Delta U_c^2 = 3 \cdot 100\pi \cdot 1 \cdot 10^{-3} \cdot 400^2 = 150,8\ kVAr$

$Q_{ne} = Q_i + Q_m - Q_c = 140 + 12,84 - 150,8 = 2,04\ kVAr$

$P_{ne} = P_i + P_m = 140 + 15 = 155\ kW$

$\tan\varphi_{ne} = \dfrac{2,04}{155} \Rightarrow \cos\varphi_{ne} = 0,999$

$\underline{I}_{ne} = \dfrac{P_{ne}}{\sqrt{3}\,U\cos\varphi_{ne}} = \dfrac{155 \cdot 10^3}{\sqrt{3} \cdot 400 \cdot 0,99} = 223,7\ A \angle -0,75°$

diskutera

$U = 400\,V$; $f = 50\,Hz$

före: $P_i = 140\,kW$; $\cos\varphi_i = 0{,}707$ $\quad \underline{I} = ?$

$Q_i = P_i \tan\varphi_i = 140\,kVA_r$ $\quad \varphi_i = 45°$

$S_i = \sqrt{2} \cdot 140\,kVA \Rightarrow I = \dfrac{S_i}{\sqrt{3}\,U} = \dfrac{\sqrt{2} \cdot 140 \cdot 10^3}{\sqrt{3} \cdot 400} = 285{,}8\,A$

$\underline{I} = 285{,}8 \angle -45°\ [A]$

efter:

$P_i = 140\,kW$; $\cos\varphi_i = 0{,}707 \Rightarrow Q_i = 140\,kVA_r$

AM $P_m = 15\,kW$; $I_m = 28{,}5\,A$

$C_\Delta = 1\,mF$

AM: $S_m = \sqrt{3} \cdot 400 \cdot 28{,}5 = 19745\,VA$

$Q_m = \sqrt{S_m^2 - P_m^2} = \sqrt{19745^2 - 15000^2} = 12840\,VA_r$

Δ - kopplad kondensatorer

$U_c = 400\,V$; $Q_c = 3\omega C_\Delta U_c^2 = 3 \cdot 100\pi \cdot 1 \cdot 10^{-3} \cdot 400^2 = 150{,}8\,kVA_r$

Effekt som skall tillföras från nätet:

$Q = Q_i + Q_m - Q_c = 140 + 12{,}84 - 150{,}8 = 2{,}04\,kVA_r$

$P = P_i + P_m = 140 + 15 = 155\,kW$

Hela lastens $\cos\varphi$:

$\tan\varphi = \dfrac{Q}{P} = \dfrac{2{,}04}{155} \Rightarrow \cos\varphi = 0{,}999$

$I = \dfrac{P}{\sqrt{3}\,U\cos\varphi} = \dfrac{155 \cdot 10^3}{\sqrt{3} \cdot 400 \cdot 0{,}999} = 223{,}7\,A$

$\underline{I} = 223{,}7 \angle -0{,}8°\ [A]$ $\quad$ Obs! $I_{efter} < I_{före}$