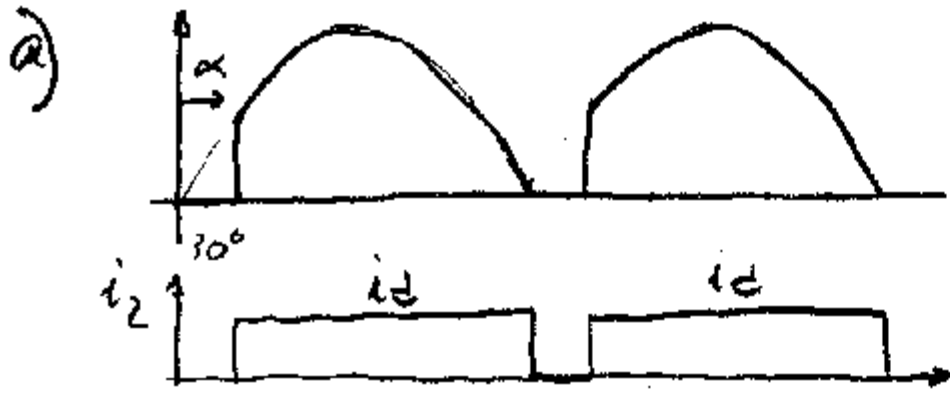
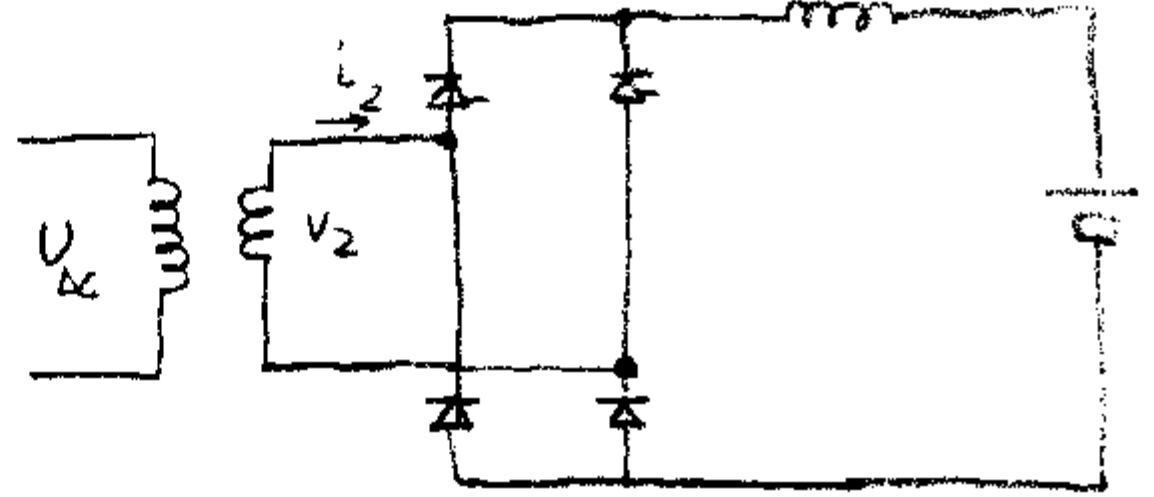


Solución problema 1.

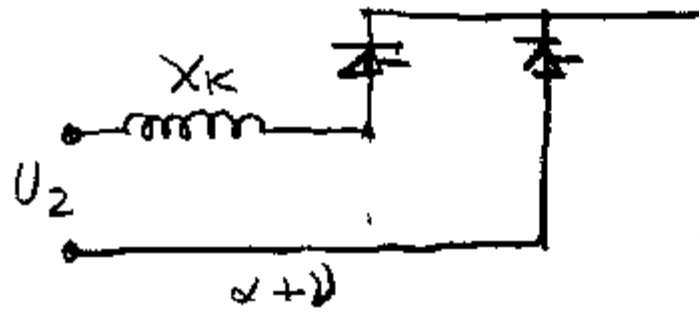
Mínimo U_2
Mínimo trazo } $\alpha = 30^\circ$



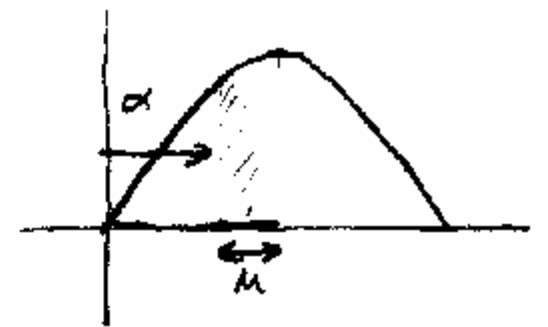
$$i_{2\text{eff}} = \sqrt{\frac{1}{180} \int_0^{150} I_d^2 d\psi} = I_d \sqrt{\frac{150}{180}}$$

$$i_{2\text{eff}} = 0,9129 \times 30\text{A} = 27,4\text{A}$$

b) la caída de tensión se produce cuando conmutan los tiristores.



$$U_2 = L_k \frac{di_k}{dt} = X_k \frac{di_k}{d\psi}$$



$$i_k = \frac{1}{X_k \alpha} \int \sqrt{2} U_2 \text{sen } \eta d\eta = \frac{\sqrt{2} U_2}{X_k} (\text{en } \alpha - \text{en}(\alpha + \nu))$$

la conmutación termina cuando $i_k = I_d$ $I_d = \frac{\sqrt{2} U_2}{X_k} (\text{en } \alpha - \text{en}(\alpha + \mu))$

$$\Delta U_x = \frac{1}{\pi} \int_{\alpha}^{\alpha + \mu} \sqrt{2} U_2 \text{sen } \eta d\eta = \frac{\sqrt{2} U_2}{\pi} (\text{en } \alpha - \text{en}(\alpha + \mu)) = \frac{X_k I_d}{\pi}$$

$$\Delta U_x = \frac{X_k I_d}{\pi}$$

$$U_d' = \frac{1}{\pi} \int_{\alpha}^{\pi} \sqrt{2} U_2 \text{sen } \eta d\eta = \frac{\sqrt{2} U_2}{\pi} (1 + \text{en } \alpha) = 0,9 \left(\frac{1 + \text{en } \alpha}{2} \right)$$

$$U_d = 0,9 \left(\frac{1 + \text{en } \alpha}{2} \right) - \frac{X_k I_d}{\pi}$$

c)
$$X_K = 0,1 \frac{U_{2n}}{I_{2n}} = \frac{0,1 \cdot U_{2min}}{0,8 I_{2n}} \quad I_{2n} = 27,4 \text{ A}$$

$$U_{dmax} = U_{2min} \cdot 0,9 \frac{(1 + \cos \alpha_{min})}{2} - \frac{X_K \cdot I_d}{\pi}$$

$$58 \text{ V} = U_{2min} \cdot 0,9 \frac{(1 + \cos 30^\circ)}{2} - \frac{0,1 \cdot U_{2min}}{0,8 \cdot 27,4 \text{ A}} \cdot \frac{30}{\pi}$$

$$U_{2min} = \frac{58 \text{ V}}{0,45(1 + \cos 30^\circ) - \frac{0,1 \cdot 30 \text{ A}}{0,8 \pi \cdot 27,4 \text{ A}}} = 72,85 \text{ V}$$

$$X_K = 0,332 \Omega \quad U_{2n} = \frac{72,85}{0,8} = 91,06 \text{ V}$$

$$n = \frac{230}{91,6} = 2,52 \quad \text{trafo } 230/91,6, 2510 \text{ VA}$$

$$X_{cc} = 0,332$$

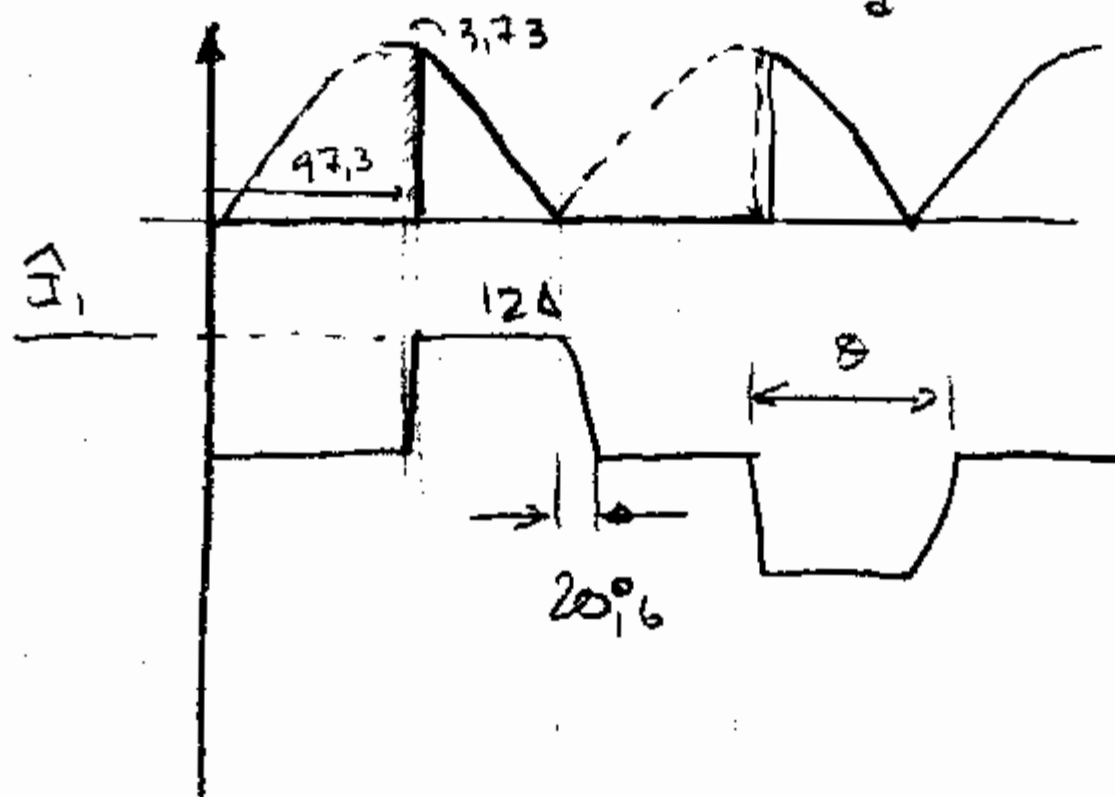
$$S = 91,6 \times 27,4 = 2510 \text{ VA}$$

d)
$$\alpha = \arccos \left(\frac{40 + \frac{0,332 \cdot 30}{\pi}}{0,45 \cdot 91,6 \cdot 1,2} - 1 \right) = 97,31^\circ$$

$$\cos \alpha = -0,127237$$

$$\mu_T = \arccos \left(-\frac{X_K I_d}{\sqrt{2} U_{2max}} + \cos \alpha \right) - \alpha = 3,73^\circ \quad \text{tiristores}$$

en diodo conmutan a $\alpha = 0 \quad \mu_d = \arccos \left(1 - \frac{X_K I_d}{\sqrt{2} U_{2max}} \right) = 20,6^\circ$



$$\hat{I}_d = 30 \cdot \frac{91,6}{230} = 12 \text{ A}$$

$$\theta = 180 - 97,3 + 20,6^\circ$$