2) 195 MVA, 15 KV, 60 HZ

$R_A = 0$

$I_F = 750A \rightarrow V_{L(VAZIO)} = 15KV$

$I_{A(C.CIRCUITO)} = 7000\ A$, $V_{L(ENT.)} = 20KV$

i) $X_S = \frac{15000}{\sqrt{3} \cdot 7000} = 1,2372\ \Omega$

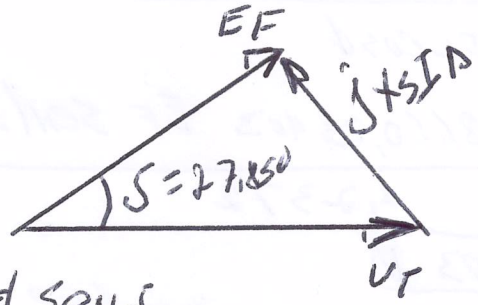
$I_L = \frac{85.306}{\sqrt{3} \cdot 15000} = 3273,7475\ A$

$E_F = \frac{15000}{\sqrt{3}} \angle 0^\circ + 3273,7475 \angle 25,84 \cdot 1,2372 \angle 90$

$E_F = 8660,25403 \angle 0^\circ + 4047,7689 \angle 115,84$

$E_F = 8660,25403 - 1764,2587 + j\,3643,0515$

$E_F = 7799,1394 \angle 27,85^\circ$ W1 $\rightarrow 13,51\ KV$




ii) $P = \frac{|V_T||E_F| \operatorname{sen}\delta}{|X_S|}$

$P_{MAX} = \frac{3 \cdot 8660,25403 \cdot 7799,1394}{1,2372} \cdot \operatorname{sen} 90^\circ$

$P_{MAX} = 163,7752\ MW$

$I_A = \frac{7799,1394 \angle 90^\circ - 8660,25403 \angle 0^\circ}{1,2372 \angle 90^\circ}$

$I_A = \frac{11654,46589 \angle 137,9948}{1,2372} = 9420,034 \angle 45,9948$

FP = 0,6925 DP.

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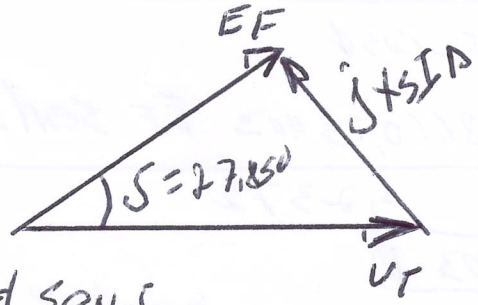



ii) $P = \frac{|V_T||E_F| \operatorname{sen}\delta}{|X_S|}$

$P_{MAX} = \frac{3 \cdot 8660,25403 \cdot 7799,1394}{1,2372} \cdot \operatorname{sen} 90^\circ$

$\boxed{P_{MAX} = 163,7752\ MW}$

$I_A = \frac{7799,1394 \angle 90^\circ - 8660,25403 \angle 0^\circ}{1,2372 \angle 90^\circ}$

$I_A = \frac{11654,46589 \angle 137,9348}{1,2372} = 9420,034 \angle 45,9348$

$FP = 0,6925$ DP.

iii) $\frac{7793,1394 \cdot 8660,25403 \cdot SEN(27,85)}{1,2372} = \frac{8660,25403\ 10138,88 SEN\delta'}{1,2372}$

$3643,4335 = 10138,88 SEN\delta'$

$SEN\delta' = 0,3594 \rightarrow \delta' = 21,0633°$

$I_A = \frac{10138,88 \angle 21,0633 - 8660,25403 \angle 0°}{1,2372 \angle 90°}$

$I_A = \frac{13334,04093 \angle 130,503 - 8660,25403 \angle 0°}{1,2372 \angle 90°}$

$I_A = 10777,60259 \angle 40,5030$

$FP = 0,7604$ AD.

$Q = 3 \cdot 8660,2543 \cdot 10777,60259\ SEN(40,503)$

$\boxed{Q = 181,863\ MVAr}$

iv) $P = \sqrt{3}\, V_L I_L \cos\phi$

$\frac{165,8 \cdot 10^3}{3} = \frac{8660,25403\ EF\ SEN(15°)}{1,2372}$

$\boxed{EF = 30,503\ V}$

$I_A = \frac{8660,25403 \angle 0° - 30,503 \angle 15°}{1,2372 \angle 90°} =$

$I_A = 8660,25403 - 29,463 - j7,895$

$I_A = \frac{8631,2946 \angle -0,0510}{1,2372 \angle 90°} = 6976,48 \angle -30,052$

$FP = \cos 30,052 \fallingdotseq 0$

3) 2000 HP, 2300 V, FP = 0,8 DD, 2 POLOS

a) $X_S = 1,5\,\Omega$ $R_A = 0,3\,\Omega$

PERDAS MEC. = 50 KW CAMPO $\begin{cases} 200\,V \\ 10\,A \end{cases}$

$P_{FE} = 40$ KW

$V_T - (0,3 + j1,5) \cdot I_A \angle\theta = EF$

$P_S = P_E - \sum PERDAS \Rightarrow 2000 \cdot 746 + 50000 + 40000 = P_E$

$\boxed{P_E = 1582000\,W}$

$I_A = \dfrac{1582000}{\sqrt{3} \cdot 2300} = 397,1282\,A$

$1327,9446 \angle 0^\circ - 1,5297 \angle 78,66^\circ \cdot 397,1282 = EF$

$1327,9446 - (607,1870 \angle 78,66^\circ) = EF$

$1327,9446 - (120,074 + j595,502) = EF$

$EF = 1346,69002 \angle -26,240\ (V)$

DO GRÁFICO $\Rightarrow IF = 2,3\,A$

b) $\eta = \dfrac{2000 \cdot 746}{1582000} \cdot 100 = 94,31\,\%$

c) $EF = 1346,69002 \times 1,05 = 1414,0245\,V$

$\dfrac{1327,9446 \cdot 1414,0245 \cdot sen(\delta)}{X_S} = \dfrac{1327,94 \cdot 46 \cdot 1346,69 sen}{1,5}$

$sen\delta = 0,4231 \Rightarrow \delta = 24,5^\circ$

$I_A = \dfrac{1327,9446 \angle 0^\circ - 1414,0245 \angle -24,5^\circ}{1,5 \angle 90^\circ}$

$I_A = \dfrac{1327,9446 - 1282,5875 + j595,36}{1,5 \angle 90^\circ}$

$I_A = \dfrac{597,0256 \angle 85,64}{1,5 \angle 90^\circ} = 398,06 \angle -4,36^\circ$

$FP = \cos(-4,36^\circ) = 0,99$

$Q = \sqrt{3} \cdot 2300 \cdot 398,06 \cdot sen(4,36) = 120,550\,KVAr$

c) FP = 1,0

$$T_{MÁX} = \frac{3 \cdot 1327,9446 \cdot 1346,69002 \cdot 60}{3600 \cdot 211}$$

$$\boxed{T_{MÁX} = 14,231 \text{ KN.m}}$$

4) 1MVA, 2300V, 60HZ, $X_S = 1,25\ \Omega$

$n = 3590$

a) $P_S = 500 \cdot 746 = 373000$ W

$$\eta = \frac{P_S}{P_E} \cdot 100 \Rightarrow 0,95 = \frac{373000}{P_E} =$$

$P_E = 392631,5789$ W

$I_A = 392631,5789 / \sqrt{3} \cdot 2300 \cdot 0,85\ \Phi$

$I_A = 195,95853$ A

$1327,9446 \angle 0° - 1,25 \angle 90° \cdot 195,9533 \angle 31,79°, EF$

$1327,9446 \angle 0° - (144,9416 \angle 58,21°) = EF$

$1327,9446 - (76,3563 + j123,1981) = EF$

$EF = 1257,6371 \angle -5,62°$ V

b) $\frac{1327,9446 \cdot 1257,6371 \cdot 0,098}{1,25} = \frac{1327,9446 \cdot 754,58}{1,25}\ \text{SEN}\delta'$

$\text{SEN}\delta' = 0,1633 \rightarrow \boxed{\delta' = 9,39°}$

$$I_A = \frac{1327,9446 \angle 0° - 754,58 \angle -9,39°}{1,25 \angle 90°} =$$

$$I_A = \frac{1327,9446 - (744,47 - j123,113)}{1,25 \angle 90°}$$

$$I_A = \frac{596,3216 \angle 11,92°}{1,25 \angle 90°} = 477,06 \angle -78,08° \text{ A}$$

$FP = \cos(78,08) = 0,21$

$P = \sqrt{3} \cdot 2300 \cdot 477,06 \cdot 0,21 = 399,09$ KW

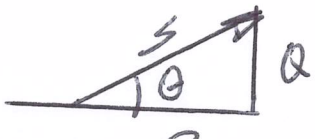
NÃO PERDERÁ SINCRONISMO

5) M.S 3ϕ, 400 KVA, 4KV

M.I.T → 500 KVA, FP = 0,8 ATRASADO

M.S → 300 KVA, FP = 1,0

a) PARA O M.I.T




$P = 500 \cdot 10^3 \cdot 0,8 = 400000\ W$

$Q = 500 \cdot 10^3 \cdot \text{SEN}(36,87°) = 300000\ VAR$

PARA M.S

$P = 300000 \cdot 1,0 = 300000\ W$

$P_T = 400000 + 300000 = 700000\ W$

$Q_T = 300000\ VAR$

$S = \sqrt{700000^2 + 300000^2} = 762000\ VAR$

$\cos\phi = FP = \frac{700000}{762000} = 0,92$ ATRASADO

b) VAR MÁXIMO DO M.S $= \sqrt{400^2 - 300^2} = 264,58$

DA FÁBRICA → $300 - j\,264,4 = j\,35,42$ ATR.

$S = \sqrt{700.10^3{}^2 + 35,42.10^3{}^2} = 700,9\ KVA$

$\cos\phi = \frac{700 \cdot 10^3}{700,9 \cdot 10^3} = 0,996$

$I_A = \frac{400 \cdot 10^3}{\sqrt{3} \cdot 4 \cdot 10^3} = 57,74\ A$

$\cos\phi = \frac{300 \cdot 10^3}{400 \cdot 10^3} = 0,75$ ADIANTADO