26.1 $U_L = 400\,V$, λ

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

26.2 $U_S = 290\,V$ λ

$$U_L = \sqrt{3} \cdot U_S = \sqrt{3} \cdot 290 = 502{,}3\,V$$

26.3 $U_L = 400\,V$ $I_L = 9{,}1\,A$

λ, Heißwasserspeicher

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$I_S = I_L$$

$$R_S = \frac{U_S}{I_S} = \frac{231}{9{,}1} = 25{,}37\,\Omega$$

26.4 $U_L = 400\,V$ $I_L = 6\,A$ λ

Ofen $\Rightarrow \cos\varphi = 1$

$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$

$= \sqrt{3} \cdot 400 \cdot 6 \cdot 1 = 4{,}17\,kW$

26.5 $U_L = 400\,V$ $P = 12\,kW$ λ

$$P_S = \frac{P}{3} = \frac{12k}{3} = 4\,kW$$

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$I_S = \frac{P_S}{U_S \cdot \cos\varphi} = \frac{4000}{231 \cdot 1} = 17{,}3\,A$$

$I_L = I_S$

$$R_S = \frac{U_S}{I_S} = \frac{231}{17{,}3} = 13{,}3\,\Omega$$

26.6 $R_S = 32\,\Omega$ $U_L = 400\,V$ Δ

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$I_S = \frac{U_S}{R_S} = \frac{231}{32} = 7{,}22\,A$$

$$P_S = U_S \cdot I_S \cdot \cos\varphi = 231 \cdot 7{,}22 \cdot 1 = 1{,}66\,kW$$

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$$

$$= \sqrt{3} \cdot 400 \cdot 7{,}22 \cdot 1 = 5\,kW$$

$$= 3 \cdot P_S = 3 \cdot 1{,}66 = 5\,kW$$

26.7 $I_L = 100\ A$ Δ

$$I_S = \frac{I_L}{\sqrt{3}} = \frac{100}{\sqrt{3}} = 57{,}7\ A$$

26.8 $U_L = 400\ V$ Δ

$R_S = 50\ \Omega$

$$U_S = U_L$$

$$I_S = \frac{U_S}{R} = \frac{400}{50} = 8\ A$$

$$I_L = \sqrt{3} \cdot I_S = \sqrt{3} \cdot 8 = 13{,}86\ A$$

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$$

$$= \sqrt{3} \cdot 400 \cdot 13{,}86 \cdot 1 = 9{,}6\ kW$$

$$P_S = U_S \cdot I_S \cdot \cos\varphi = 400 \cdot 8 \cdot 1 = 3200\ W$$

$$P = 3 \cdot P_S = 3 \cdot 3200 = 9600\ W$$

26. P $U_L = 400\,V$ $I_L = 36{,}5\,A$

Δ

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$$

$$= \sqrt{3} \cdot 400 \cdot 36{,}5 \cdot 1 = 25{,}3\,kW$$

$$P_S = \frac{P}{3} = \frac{25{,}3\,k}{3} = 8{,}4\,kW$$

26.10 $U_L = 400\,V$ $P = 6\,kW$ Δ

$$I_L = \frac{P}{\sqrt{3} \cdot U_L \cdot \cos\varphi} = \frac{6000}{\sqrt{3} \cdot 400 \cdot 1}$$

$$= 8{,}66\,A$$

26.11 $U_L = 400\,V$ $R_S = 44\,\Omega$

λ, Δ

λ Schaltung

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$I_S = \frac{U_S}{R_S} = \frac{231}{44} = 5{,}25\,A$$

$$P_S = U_S \cdot I_S \cdot \cos\varphi = 231 \cdot 5{,}25 \cdot 1 = 1213\,W$$

$$P = 3 \cdot P_S = 3 \cdot 1213 = 3638\,W$$

Δ Schaltung

$$U_S = U_L$$

$$I_S = \frac{U_S}{R_S} = \frac{400}{44} = 9{,}09\,A$$

$$P_S = U_S \cdot I_S \cdot \cos\varphi = 400 \cdot 9{,}09 \cdot 1 = 3{,}63\,kW$$

$$P = 3 \cdot P_S = 3 \cdot 3{,}63\,k = 10{,}89\,kW$$

Verhältnis der Leistungen:

$$\frac{P_Y}{P_\Delta} = \frac{3{,}6\,kW}{10{,}9\,kW} = \frac{1}{3} = \underline{1:3}$$

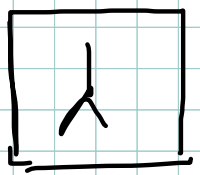
26.12 $U_L = 400\,V$ $I_L = 27{,}3\,A$

Δ

$$U_S = U_L$$

$$I_S = \frac{I_L}{\sqrt{3}} = \frac{27{,}3}{\sqrt{3}} = 15{,}76\,A$$

$$R_S = \frac{U_S}{I_S} = \frac{400}{15{,}76} = 25{,}38\,\Omega$$



$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$I_S = \frac{U_S}{R_S} = \frac{231}{25{,}38} = 9{,}1\,A$$

$$I_L = I_S$$

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$$

$$= \sqrt{3} \cdot 400 \cdot 9{,}1 \cdot 1 = 6{,}3\,kW$$

26.13 $U_L = 400\,V$ $I_L = 9{,}1\,A$

λ P und I_L sind Verschieden !!

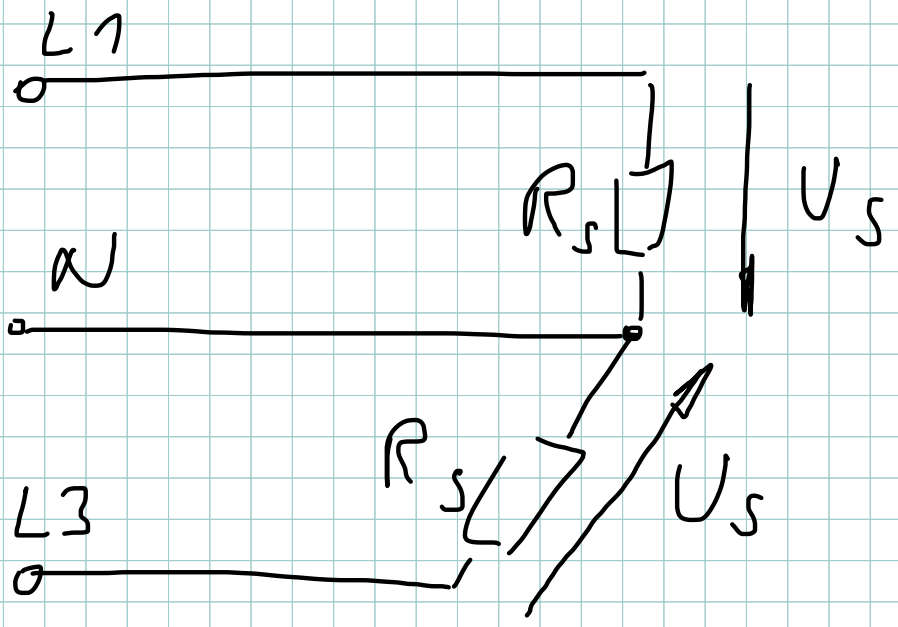
Ungestörter Betrieb:

$$I_S = I_L$$

$$U_S = \frac{U_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\,V$$

$$R_S = \frac{U_S}{I_S} = \frac{231}{P_1} = 25{,}4\,\Omega$$

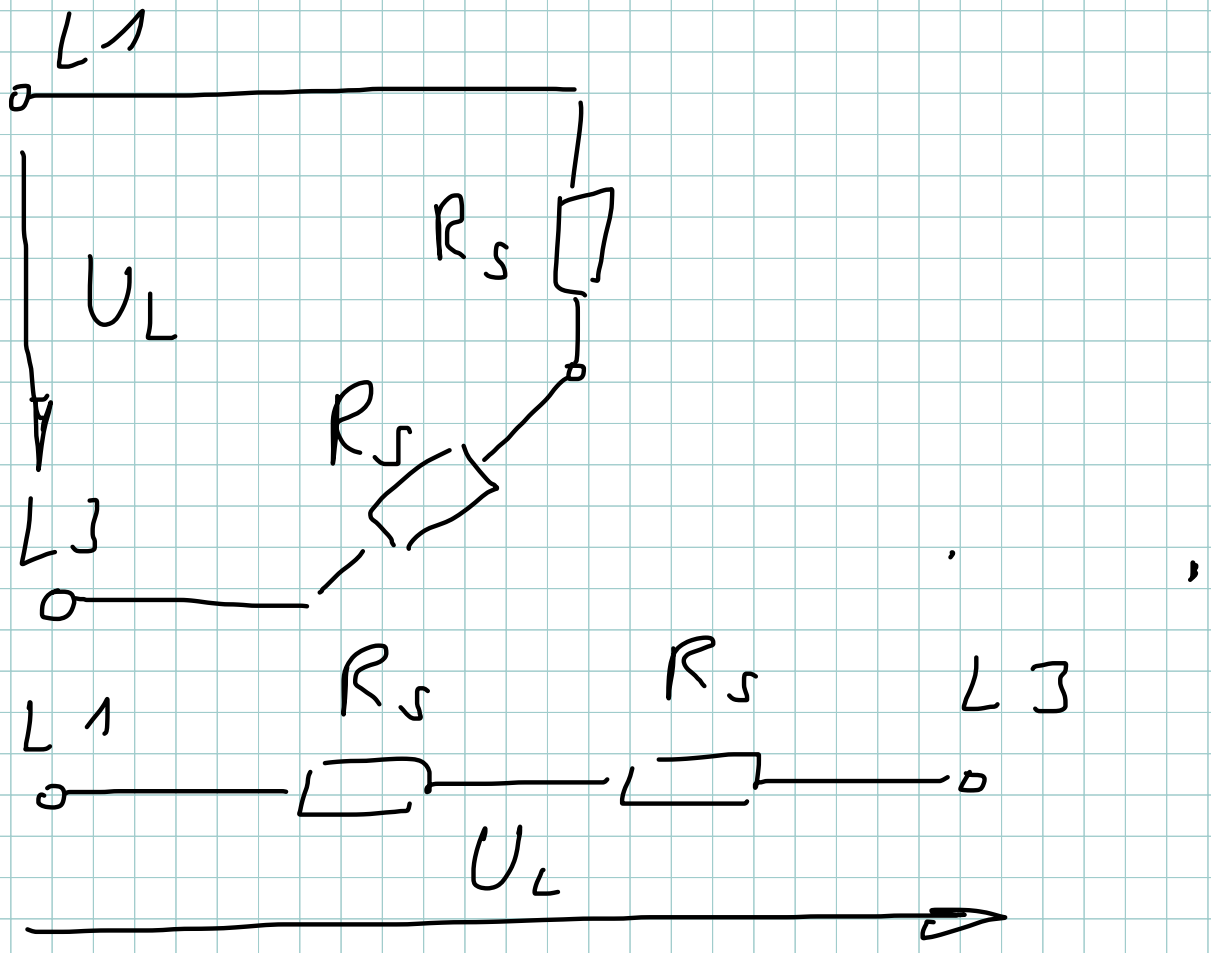
Ausfall eines Stranges mit N-Leiter



$$P_S = U_S \cdot I_S \cdot \cos\varphi = 231 \cdot 9,1 \cdot 1 = 2102\,W$$

$$P = 2 \cdot P_S = 2 \cdot 2102 = 4,2\,kW$$

Ausfall eines Stranges ohne N-Leiter



$$R_g = 2 \cdot R_S = 2 \cdot 25{,}4 = 50{,}8\,\Omega$$

$$I = \frac{U_L}{R_g} = \frac{400}{50{,}8} = 7{,}87\,A$$

$$P = U \cdot I \cdot \cos\varphi = 400 \cdot 7{,}87 \cdot 1 = 3{,}15\,kW$$

26.14 $U = 400\,V$ $R = 18\,\Omega$

Δ $\cos\varphi = 1$

$$U_S = U_L$$

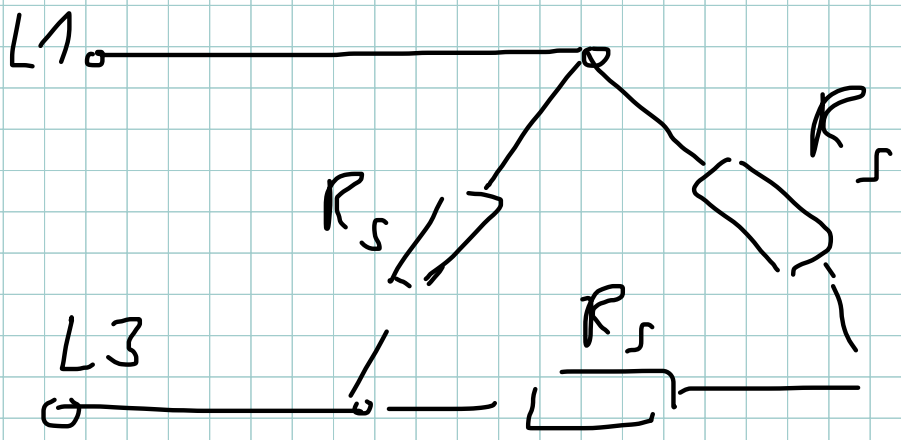
$$I_S = \frac{U_S}{R_S} = \frac{400}{18} = 22{,}2\,A$$

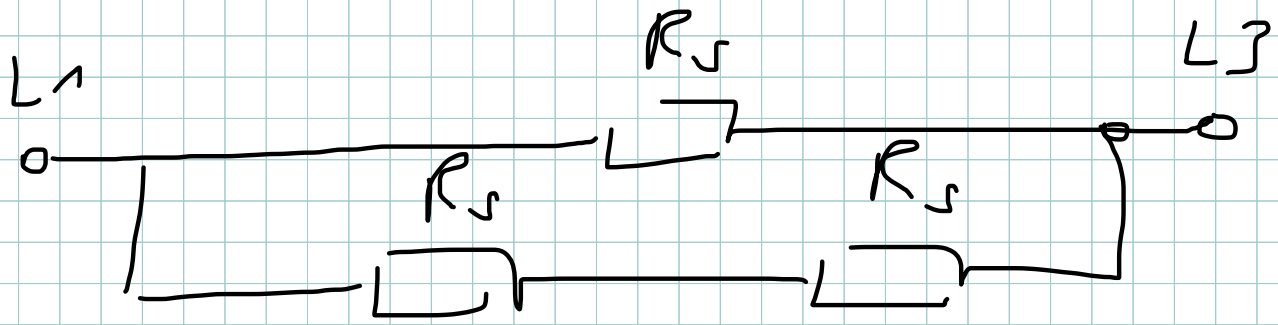
$$I_L = \sqrt{3} \cdot I_S = \sqrt{3} \cdot 22{,}2 = 38{,}5\,A$$

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi = \sqrt{3} \cdot 400 \cdot 38{,}5 \cdot 1$$

$$= 26{,}6\,kW$$

Ausfall einer Phase





$$R_{12} = 2 \cdot R_S = 2 \cdot 18 = 36\ \Omega$$

$$R_g = \frac{R_S \cdot R_{12}}{R_S + R_{12}} = \frac{18 \cdot 36}{18 + 36} = 12\ \Omega$$

$$P = \frac{U^2}{R} = \frac{400^2}{12} = 13{,}\dot{3}\ kW$$

26.15 Motor $U_L = 400\,V$

$I_L = 2{,}2\,A$ $\cos\varphi = 0{,}79$

$$P = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi$$

$$= \sqrt{3} \cdot 400 \cdot 2{,}2 \cdot 0{,}79 = 1204\,W$$

26.16 $U_L = 400\,V$ $P = 2{,}2\,kW$

$\cos\varphi = 0{,}81$

$$I_L = \frac{P}{\sqrt{3} \cdot U_L \cdot \cos\varphi}$$

$$= \frac{2200}{\sqrt{3} \cdot 400 \cdot 0{,}81} = 3{,}92\,A$$

26.17 $U_L = 400\,V$ $I_L = 3{,}2\,A$

Sollen $\longrightarrow$ (230 V) $\rightarrow$ (5,55 A)

$P_{ab} = 1{,}5\,kW$

$\cos\varphi = 0{,}86$

$$P_{zu} = \sqrt{3} \cdot U_L \cdot I_L \cdot \cos\varphi =$$

$$= \sqrt{3} \cdot 400 \cdot 3{,}2 \cdot 0{,}86 =$$

$$= 1{,}9\,kW$$

$$\eta = \frac{P_{ab}}{P_{zu}} = \frac{1{,}5\,k}{1{,}9\,k} = 0{,}787$$

$$= 78{,}7\,\%$$

eda

26.18 Motor $U_L = 400\ V$

$P_{ab} = 7{,}5\ kW$

$\cos\varphi = 0{,}8$ $\quad \eta = 0{,}86$

$$P_{zu} = \frac{P_{ab}}{\eta} = \frac{7{,}5\ k}{0{,}86} = 8{,}72\ kW$$

$$I_L = \frac{P_{zu}}{\sqrt{3} \cdot U_L \cdot \cos\varphi} =$$

$$= \frac{8721}{\sqrt{3} \cdot 400 \cdot 0{,}8} = 15{,}73\ A$$

26.19 $P = 720\,kW$ $U_L = 400\,V$

$\cos\varphi_1 = 0{,}7$ (ohne Komp.)

$\cos\varphi_2 = 0{,}9$ (mit Komp.)

$$S_1 = \frac{P}{\cos\varphi_1} = \frac{720\,k}{0{,}7} = 1028{,}6\,kVA$$

$$I_{L1} = \frac{S_1}{\sqrt{3}\cdot U_L} = \frac{1028{,}6\,k}{\sqrt{3}\cdot 400} = 1485\,A$$

Mit Kompensation

$$S_2 = \frac{P}{\cos\varphi_2} = \frac{720\,k}{0{,}9} = 800\,kVA$$

$$I_2 = \frac{S_2}{\sqrt{3}\cdot U_L} = \frac{800\,k}{\sqrt{3}\cdot 400} = 1155\,A$$

26.20 $U_L = 400\,V$ $I_L = 6,4\,A$

$\cos\varphi = 0,84$

$$S = \sqrt{3} \cdot U_L \cdot I_L = \sqrt{3} \cdot 400 \cdot 6,4 = 4,43\,kVA$$

$$P = S \cdot \cos\varphi = 4,43\,k \cdot 0,84 = 3725\,W$$

$$Q = \sqrt{S^2 - P^2} = \sqrt{4434^2 - 3725^2} =$$

$$= 2405\,Var$$

26.21 $P_{ab} = 4\,kW$

$U_L = 400\,V$ $I_L = 9\,A$

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

$$S = \sqrt{3} \cdot U_L \cdot I_L = \sqrt{3} \cdot 400 \cdot 9 = 6235\,VA$$

$$P = S \cdot \cos\varphi = 6235 \cdot 0{,}8 = 4988\,W$$

$$Q = \sqrt{S^2 - P^2} = \sqrt{6235^2 - 4988^2} = 3741\,Var$$

$$\eta = \frac{P_{ab}}{P_{zu}} = \frac{4000}{4988} = 0{,}801$$

$$= 80{,}2\,\%$$

26.22 $U_L = 400\,V$ $I_L = 3{,}5\,A$

$t = 30''$ $n = 4$

$C_z = 750\,\frac{1}{kWh}$

1~ zählt $\Rightarrow \times 3$

750 Umdrehungen $\hat{=}$ 1 kWh

4 — n — $\hat{=}$ 2 kWh

$$W = \frac{n}{C_z} = \frac{4}{750}\,kWh = 5{,}3\,Wh$$

$$= 19.200\,Ws$$

$$P = \frac{3 \cdot W}{t} = \frac{3 \cdot 19200\,Ws}{30\,s} = 1920\,W$$

$$S = \sqrt{3} \cdot U_L \cdot I_L = \sqrt{3} \cdot 400 \cdot 3{,}5 = 2425\,VA$$

$$Q = \sqrt{S^2 - P^2} = \sqrt{2425^2 - 1920^2} = 1481\,Var$$

26.23 $U_L = 400\,V$ $I_L = 33\,A$

$P_{zu} = 18{,}1\,kW$

$M = 105\,Nm$ $n = 1460\,\frac{1}{min}$

$$\cos\varphi = \frac{P_{zu}}{\sqrt{3}\cdot U_L \cdot I_L} = \frac{18{,}1\,k}{\sqrt{3}\cdot 400 \cdot 33} =$$

$$= 0{,}79$$

$$P_{ab} = \frac{M \cdot n}{9{,}55} = \frac{105 \cdot 1460}{9{,}55} = 16\,kW$$

$$\eta = \frac{P_{ab}}{P_{zu}} = \frac{16\,k}{18{,}1\,k} = 0{,}884$$