

Nº 5.1.1

$$\text{Rapport} = \frac{U}{U} = \frac{231,8}{134} = \underline{\underline{1,73}}$$

Nº 5.1.2

$$U = U_{Ph} \cdot \sqrt{3} = 220 \cdot 1,73 = \underline{\underline{380 \text{ V}}}$$

Nº 5.1.3

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{530}{1,73} = \underline{\underline{306 \text{ V}}}$$

Nº 5.1.4

$$I = I_{Ph} \cdot \sqrt{3} = 18,3 \cdot 1,73 = \underline{\underline{31,7 \text{ A}}}$$

Nº 5.1.5

$$I_{Ph} = \frac{I}{\sqrt{3}} = \frac{5,52}{1,73} = \underline{\underline{3,187 \text{ A}}}$$

Nº 5.1.6

$$U = U_{Ph} \cdot \sqrt{3} = 226 \cdot 1,73 = \underline{\underline{391,4 \text{ V}}}$$

Nº 5.1.7

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{10,5}{1,73} = \underline{\underline{6,062 \text{ kV}}}$$

Nº 5.1.8

$$I = I_{Ph} \cdot \sqrt{3} = 875 \cdot 1,73 = \underline{\underline{1516 \text{ A}}}$$

Nº 5.1.9

$$I_{Ph} = \frac{I}{\sqrt{3}} = \frac{270}{1,73} = \underline{\underline{155,9 \text{ mA}}}$$

Nº 5.1.10

$$U = U_{Ph} \cdot \sqrt{3} = 50 \cdot 1,73 = \underline{\underline{86,6 \text{ V}}}$$

Nº 5.1.11

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{50}{1,73} = \underline{\underline{28,87 \text{ kV}}}$$

Nº 5.1.12

$$I = I \cdot \sqrt{3} = 2,28 \cdot 1,73 = \underline{\underline{3,949 A}}$$

Nº 5.1.13

$$I = \frac{I}{\sqrt{3}} = \frac{32}{1,73} = \underline{\underline{18,48 A}}$$

Nº 5.2.1.1

$$S = U \cdot I \cdot \sqrt{3} = 385 \cdot 23,2 \cdot 1,73 = \underline{\underline{15,47 kVA}}$$

Nº 5.2.1.2

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 515 \cdot 12,5 \cdot 1,73 \cdot 1 = \underline{\underline{11,15 kW}}$$

Nº 5.2.1.3

$$Q = U \cdot I \cdot \sqrt{3} = 388 \cdot 61,5 \cdot 1,73 = \underline{\underline{43,75 kvar}}$$

Nº 5.2.1.4

$$S = U \cdot I \cdot \sqrt{3} = 500 \cdot 25 \cdot 1,73 = \underline{\underline{21,65 kVA}}$$

Nº 5.2.1.5

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 380 \cdot 4,2 \cdot 1,73 \cdot 1 = \underline{\underline{2,764 kW}}$$

Nº 5.2.1.6

$$I = \frac{S}{U \cdot \sqrt{3}} = \frac{8000}{400 \cdot 1,73} = \underline{\underline{11,55 A}}$$

Nº 5.2.1.7

$$I = \frac{P}{U \cdot \sqrt{3} \cdot \cos \varphi} = \frac{10500}{380 \cdot 1,73 \cdot 1} = \underline{\underline{15,95 A}}$$

Nº 5.2.1.8

$$I = \frac{Q}{U \cdot \sqrt{3}} = \frac{32000}{380 \cdot 1,73} = \underline{\underline{48,62 A}}$$

Nº 5.2.1.9

$$U = \frac{P}{I \cdot \sqrt{3} \cdot \cos \varphi} = \frac{5500}{8,3 \cdot 1,73 \cdot 1} = \underline{\underline{382,58}} \Rightarrow \underline{\underline{3 \times 380 V}}$$

Nº 5.2.1.10

$$I = \frac{P}{u \cdot \sqrt{3} \cdot \cos \varphi} = \frac{510000}{580 \cdot 1,73 \cdot 1} = \underline{\underline{774,9 \text{ A}}}$$

Nº 5.2.1.11

$$U = \frac{P}{I \cdot \sqrt{3} \cdot \cos \varphi} = \frac{3600}{5,8 \cdot 1,73 \cdot 1} = \underline{\underline{38392,2 \text{ V}}}$$

Nº 5.2.1.12

$$I = \frac{P}{u \cdot \sqrt{3} \cdot \cos \varphi} = \frac{0}{580 \cdot 1,73 \cdot 1} = \underline{\underline{0 \text{ A}}}$$

$$I = " = \frac{2000}{380 \cdot 1,73 \cdot 1} = \underline{\underline{3,039 \text{ A}}}$$

$$I = " = \frac{4000}{380 \cdot 1,73 \cdot 1} = \underline{\underline{6,078 \text{ A}}}$$

$$I = " = \frac{6000}{380 \cdot 1,73 \cdot 1} = \underline{\underline{9,116 \text{ A}}}$$

Nº 5.2.1.13

$$I = \frac{P}{u \cdot \sqrt{3} \cdot \cos \varphi} = \frac{10200}{380 \cdot 1,73 \cdot 1} = \underline{\underline{15,5 \text{ A}}}$$

$$I_2 = \frac{P}{u \cdot \sqrt{3} \cdot \cos \varphi} = \frac{10200}{220 \cdot 1,73 \cdot 1} = \underline{\underline{26,77 \text{ A}}}$$

$$\text{Rapport} = \frac{I_2}{I} = \frac{26,77}{15,5} = \underline{\underline{1,73}} = \underline{\underline{\sqrt{3}}}$$

Nº 5.2.2.1

$$U = \frac{u}{\sqrt{3}} = \frac{400}{1,73} = 230,94 \text{ V}$$

$$P = \frac{U^2}{R} \cdot 3 = \frac{230,94^2}{230} \cdot 3 = \underline{\underline{695,7 \text{ W}}}$$

Nº 5.2.2.2

$$P = \frac{P}{3} = \frac{14200}{3} = 4733,33 \text{ W}$$

$$U = \frac{u}{\sqrt{3}} = \frac{380}{1,73} = 219,39 \text{ V}$$

$$R = \frac{U^2}{P} = \frac{219,39^2}{4733,33} = \underline{\underline{10,17 \Omega}}$$

Nº 5.2.2.3

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = 219,39 \text{ V}$$

$$S = \frac{S}{3} = \frac{18000}{3} = 6000 \text{ VA}$$

$$I = \frac{S}{U} = \frac{6000}{219,39} = \underline{\underline{27,35 \text{ A}}}$$

$$Z = \frac{U}{I} = \frac{219,39}{27,35} = \underline{\underline{8,022 \Omega}}$$

Nº 5.2.2.4

$$P = R \cdot I^2 \cdot 3 = 45 \cdot 4,9^2 \cdot 3 = \underline{\underline{3,241 \text{ kW}}}$$

Nº 5.2.2.5

$$\text{a)} U = U_{Ph} \cdot \sqrt{3} = 130 \cdot 1,73 = \underline{\underline{225,16 \text{ V}}}$$

$$\text{b)} P = \frac{U^2 \cdot 3}{R} = \frac{130^2}{150} \cdot 3 = \underline{\underline{338 \text{ W}}}$$

Nº 5.2.2.6

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{50}{1,73} = 28,86 \text{ V}$$

$$\text{a)} I = \frac{U}{R} = \frac{28,86}{0,0425} = \underline{\underline{679,23 \text{ A}}}$$

$$\text{b)} P = R \cdot I^2 \cdot 3 = 0,0425 \cdot 679,23^2 \cdot 3 = \underline{\underline{58,82 \text{ kW}}}$$

Nº 5.2.2.7

$$P = \frac{U^2}{R} \cdot 3 = \frac{380^2}{30} \cdot 3 = \underline{\underline{14,59 \text{ kW}}}$$

Nº 5.2.2.8

$$P = \frac{P}{3} = \frac{9600}{3} = 3200 \text{ W}$$

$$R = \frac{U^2}{P} = \frac{220^2}{3200} = \underline{\underline{15,13 \Omega}}$$

Nº 5.2.2.9

$$\text{c)} \quad I_{Ph} = \frac{U}{R} = \frac{220}{120} = \underline{\underline{1,83 A}}$$

$$\text{a)} \quad I = I_{Ph} \cdot \sqrt{3} = 1,83 \cdot 1,73 = \underline{\underline{3,175 A}}$$

$$\text{b)} \quad S = U \cdot I \cdot \sqrt{3} = 220 \cdot 3,175 \cdot 1,73 = \underline{\underline{1,218 \text{ kVA}}}$$

Nº 5.2.2.10

$$\text{a)} \quad P = \frac{U^2}{R} = \frac{220^2}{32} = \underline{\underline{1,513 \text{ kW}}}$$

$$\text{b)} \quad P_{\text{tot.}} = P \cdot 3 = 1,513 \cdot 3 = \underline{\underline{4,538 \text{ kW}}}$$

$$\text{c)} \quad U = U_{Ph} \cdot \sqrt{3} = 220 \cdot 1,73 = \underline{\underline{380 V}}$$

Nº 5.2.2.11

$$I = \frac{P}{U \cdot \sqrt{3}} = \frac{6800}{380 \cdot 1,73} = 10,33 A$$

$$\text{a)} \quad I_{Ph} = \frac{I}{\sqrt{3}} = \frac{10,33}{1,73} = \underline{\underline{5,965 A}}$$

$$\text{b)} \quad R = \frac{U_{Ph}}{I_{Ph}} = \frac{380}{5,965} = \underline{\underline{63,71 \Omega}}$$

Nº 5.2.2.12

$$\text{a)} \quad I = I_{Ph} \cdot \sqrt{3} = 4,34 \cdot 1,73 = \underline{\underline{7,517 A}}$$

$$\text{b)} \quad P = U \cdot I \cdot \sqrt{3} = 500 \cdot 7,517 \cdot 1,73 = \underline{\underline{6,51 \text{ kW}}}$$

$$\text{c)} \quad R = \frac{U_{Ph}}{I_{Ph}} = \frac{500}{4,34} = \underline{\underline{115,2 \Omega}}$$

Nº 5.2.2.13

$$\text{a)} \quad I = \frac{U}{R} \cdot \sqrt{3} = \frac{380}{25} \cdot 1,73 = \underline{\underline{26,30 A}}$$

$$\text{b)} \quad = \frac{U}{R} = \frac{220}{25} = \underline{\underline{8,8 A}}$$

Nº 5.2.2.14

$$Q = \frac{Q}{3} = \frac{32000}{3} = 10666,66 \text{ Var}$$

$$R = \frac{U^2}{Q} = \frac{380^2}{10666,66} = \underline{\underline{13,54 \Omega}}$$

Nº 5.2.2.15

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{500}{1,73} = 288,68 \text{ V}$$

$$\text{a) Y } P = \frac{U^2}{R} \cdot 3 = \frac{380^2}{13,54} \cdot 3 = \underline{\underline{2,874 \text{ kW}}}$$

$$\text{b) } \Delta P = \frac{U^2}{R} \cdot 3 = \frac{380^2}{87} \cdot 3 = \underline{\underline{8,620 \text{ kW}}}$$

$$\text{Rapport} = \frac{P\Delta}{PY} = \frac{8,620}{2,874} = \underline{\underline{1 \div 3}}$$

Nº 5.2.2.16

$$P_{Ph.} = \frac{P}{3} = \frac{7500}{3} = 2500 \text{ W}$$

$$U_{Ph} = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = 220 \text{ V}$$

$$\text{a) Y } R = \frac{U^2}{P} = \frac{220^2}{2500} = \underline{\underline{19,36 \Omega}}$$

$$\text{b) } \Delta R = \frac{U^2}{P} = \frac{380^2}{2500} = \underline{\underline{57,76 \Omega}}$$

$$\text{c) Rapport} = \frac{R\Delta}{R_Y} = \frac{57,76}{19,36} = \underline{\underline{1 \div 3}}$$

Nº 5.2.2.17

$$PY = \frac{P\Delta}{3} = \frac{9}{3} = 3 \text{ kW}$$

$$P_{tot} = P\Delta + PY = 9 + 3 = \underline{\underline{12 \text{ kW}}}$$

Nº 5.2.2.18

$$P_{Ph} = \frac{P}{3} = \frac{12000}{3} = 4000 \text{ W}$$

$$\text{a) } R_Y = \frac{U^2}{P} = \frac{220^2}{4000} = \underline{\underline{12,1 \Omega}}$$

$$\text{b) } R\Delta = \frac{U^2}{P} = \frac{380^2}{4000} = \underline{\underline{36,1 \Omega}}$$

$$\text{c) Rapport} = \frac{R\Delta}{R_Y} = \frac{36,1}{12,1} = \underline{\underline{1 \div 3}}$$

Nº 5.2.3.1

$$a) P = S \cdot \cos \varphi = 110 \cdot 0,82 = \underline{\underline{90,2 \text{ MW}}}$$

$$b) Q = S \cdot \sin \varphi = 110 \cdot 0,572 = \underline{\underline{62,96 \text{ var}}}$$

Nº 5.2.3.2

$$S = U \cdot I \cdot \sqrt{3} = 388 \cdot 1,12 \cdot 1,73 = 752,68 \text{ VA}$$

$$\cos \varphi = \frac{P}{S} = \frac{150}{752,68} = \underline{\underline{0,1993}}$$

Nº 5.2.3.3

$$\cos \varphi = \frac{P}{S} = \frac{48}{54} = \underline{\underline{0,88}}$$

$$I = \frac{P}{U \cdot \sqrt{3} \cdot \cos \varphi} = \frac{48000}{500 \cdot 1,73 \cdot 0,88} = \underline{\underline{62,36 \text{ A}}}$$

Nº 5.2.3.4

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 10000 \cdot 2520 \cdot 1,73 \cdot 0,75 = \underline{\underline{32,735 \text{ MW}}}$$

Nº 5.2.3.5

$$P = S \cdot \cos \varphi = 95 \cdot 0,8 = \underline{\underline{76 \text{ MW}}}$$

$$I = \frac{P}{U \cdot \sqrt{3} \cdot \cos \varphi} = \frac{76000000}{7500 \cdot 1,73 \cdot 0,8} = \underline{\underline{7313 \text{ kA}}}$$

Nº 5.2.3.6

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 390 \cdot 125 \cdot 1,73 \cdot 0,8 = \underline{\underline{67,545 \text{ kW}}}$$

Nº 5.2.3.7

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 380 \cdot 12,2 \cdot 1,73 \cdot 0,82 = \underline{\underline{6,584 \text{ kW}}}$$

Nº 5.2.3.8

$$S = U \cdot I \cdot \sqrt{3} = 508 \cdot 120 \cdot 1,73 = 105,585 \text{ kVA}$$

$$\cos \varphi = \frac{P}{S} = \frac{88,2}{105,585} = \underline{\underline{0,835}}$$

Nº 5.2.3.9

$$S = U \cdot I \cdot \sqrt{3} = 382 \cdot 1,12 \cdot 1,73 = 741 \text{ VA}$$

$$\cos \varphi = \frac{P}{S} = \frac{116}{741} = \underline{\underline{0,1565}}$$

Nº 5.2.3.10

$$I = \frac{P}{U \cdot \sqrt{3} \cdot \cos \varphi} = \frac{55'000'000}{50'000 \cdot 1,73 \cdot 0,9} = 705,65 \text{ A}$$

$$I \text{ conducteur} = \frac{I}{n} = \frac{705,65}{2} = \underline{\underline{352,8 \text{ A}}}$$

Nº 5.2.3.11

$$\text{a)} S = U \cdot I \cdot \sqrt{3} = 220 \cdot 16 \cdot 1,73 = \underline{\underline{6,097 \text{ kVA}}}$$

$$\text{b)} P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 220 \cdot 16 \cdot 1,73 \cdot 0,85 = \underline{\underline{5,182 \text{ kW}}}$$

$$\text{c)} Q = \sqrt{S^2 - P^2} = \sqrt{6,097^2 - 5,182^2} = \underline{\underline{3,21 \text{ kvar}}}$$

Nº 5.2.3.12

$$\text{a)} S = U \cdot I \cdot \sqrt{3} = 380'000 \cdot 605 \cdot 1,73 = \underline{\underline{398,2 \text{ MVA}}}$$

$$\text{b)} P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 380'000 \cdot 605 \cdot 1,73 \cdot 0,88 = \underline{\underline{350,41 \text{ MW}}}$$

Nº 5.2.3.13

$$\text{a)} S = U \cdot I \cdot \sqrt{3} = 10'500 \cdot 4700 \cdot 1,73 = \underline{\underline{85,476 \text{ MVA}}}$$

$$\text{b)} P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 10'500 \cdot 4700 \cdot 1,73 \cdot 0,9 = \underline{\underline{76,929 \text{ MW}}}$$

Nº 5.2.3.14

$$\text{a)} P = S \cdot \cos \varphi = 400 \cdot 0,9 = \underline{\underline{360 \text{ MW}}}$$

$$\text{b)} Q = \sqrt{S^2 - P^2} = \sqrt{400^2 - 360^2} = \underline{\underline{174,356 \text{ Mvar}}}$$

$$\text{c)} I = \frac{P}{U \cdot \sqrt{3} \cdot \cos \varphi \cdot n} = \frac{360'000'000}{380'000 \cdot 1,73 \cdot 0,9 \cdot 2} = \underline{\underline{303,87 \text{ A}}}$$

Nº 5.2.3.15

$$\text{a)} I = \frac{S}{U \cdot \sqrt{3}} = \frac{11'000}{380'000 \cdot 1,73} = \underline{\underline{16,71 \text{ A}}}$$

$$\text{b)} P = S \cdot \cos \varphi = 11 \cdot 0,8 = \underline{\underline{8,8 \text{ kW}}}$$

Nº 5.3.1.1

$$P = \frac{U^2}{R} \cdot z = \frac{220^2}{85} \cdot 2 = \underline{\underline{1,139 \text{ kW}}}$$

Nº 5.3.1.2

$$P_1 = \frac{U^2}{R_1} = \frac{220^2}{44} = 1,161 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{220^2}{50} = 1,021 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 = 1,161 + 1,021 = \underline{\underline{2,182 \text{ kW}}}$$

Nº 5.3.1.3

$$P = \frac{U^2}{R} \cdot z = \frac{220^2}{44} \cdot 2 = \underline{\underline{2,2 \text{ kW}}}$$

Nº 5.3.1.4

$$P_1 = \frac{U^2}{R_1} = \frac{214^2}{22} = 2,082 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{214^2}{38} = 1,205 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 = 2,082 + 1,205 = \underline{\underline{3,287 \text{ kW}}}$$

Nº 5.3.1.5

$$P = \frac{U^2 \cdot z}{R} = \frac{378^2}{240} \cdot 2 = \underline{\underline{1,191 \text{ kW}}}$$

Nº 5.3.1.6

$$P_1 = \frac{U^2}{R_1} = \frac{500^2}{100} = 2,5 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{500^2}{167} = 1,497 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 = 2,5 + 1,497 = \underline{\underline{3,997 \text{ kW}}}$$

Nº 5.3.1.7

$$P = \frac{U^2 \cdot z}{R} = \frac{380^2}{50} \cdot 2 = \underline{\underline{5,776 \text{ kW}}}$$

Nº 5.3.1.8

$$P_1 = \frac{U^2}{R_1} = \frac{220^2}{42} = 1,15 \text{ e kW}$$

N° 5.3.1.8 suite

$$P_2 = \frac{U^2}{R_2} = \frac{220^2}{85} = 1,383 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 = 1,182 + 1,383 = \underline{\underline{2,535 \text{ kW}}}$$

N° 5.3.1.9

$$P = \frac{P}{n} = \frac{12000}{2} = 6000 \text{ W}$$

$$R = \frac{U^2}{P} = \frac{500^2}{6000} = \underline{\underline{41,67 \Omega}}$$

N° 5.3.1.10

$$U_{\text{Ph}} = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = 219,39 \text{ V}$$

$$P_{\text{élément}} = \frac{P}{n} = \frac{5}{3} = 1666,66 \text{ W}$$

$$R = \frac{U^2}{P} = \frac{219,39^2}{1666,66} = 28,88 \Omega$$

$$R_{\text{tot.}} = R + \left(\frac{R}{n} \right) = 28,88 + \left(\frac{28,88}{2} \right) = 43,32 \Omega$$

a) $P = \frac{U^2}{R} = \frac{380^2}{43,32} = \underline{\underline{3,333 \text{ kW}}}$

$$I = \frac{U}{R} = \frac{380}{43,32} = 8,770 \text{ A}$$

b) $U_1 = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = \underline{\underline{219,39 \Rightarrow 220 \text{ V}}}$

c) $U_1 = R_1 \cdot I = 28,88 \cdot 8,770 = \underline{\underline{253,33 \text{ V}}}$

N° 5.3.1.11

$$P = P_1 + P_2 + P_3 = 1,2 + 1,82 + 0,94 = \underline{\underline{3,96 \text{ kW}}}$$

N° 5.3.1.12

$$P = P_1 + P_2 + P_3 + P_4 + P_5 = 200 + 120 + 225 + 800 + 1200 = \underline{\underline{2,545 \text{ kW}}}$$

N° 5.3.1.14

$$P_1 = U_{\text{Ph}} \cdot I = 224 \cdot 6 = 1,344 \text{ kW}$$

$$P_2 = U_{\text{Ph}} \cdot I = 224 \cdot 8 = 1,792 \text{ kW}$$

$$P_3 = U_{\text{Ph}} \cdot I = 224 \cdot 4 = 0,896 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 + P_3 = 1,344 + 1,792 + 0,896 = \underline{\underline{4,032 \text{ kW}}}$$

Nº 5.3.1.13

$$P = P_1 + P_2 + P_3 = 300 + 1200 + 1800 + 375 + 3000 + 150 = \underline{\underline{6,825 \text{ kW}}}$$

Nº 5.3.1.15

$$I \text{ moyen} = \frac{62 + 75 + 51}{3} = 62 \text{ A}$$

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 380 \cdot 62 \cdot 1,73 \cdot 0,82 = \underline{\underline{33,46 \text{ kW}}}$$

Nº 5.3.1.16

$$I \text{ moyen} = \frac{58 + 62 + 47}{3} = 55,66 \text{ A}$$

$$P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 380 \cdot 55,66 \cdot 1,73 \cdot 0,78 = 28,58 \text{ kW}$$

$$S = U \cdot I \cdot \sqrt{3} = 380 \cdot 55,66 \cdot 1,73 = \underline{\underline{36,64 \text{ kVA}}}$$

Nº 5.3.1.17

$$P_1 = \frac{U^2}{R_1} = \frac{220^2}{10} = 4,84 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{220^2}{15} = 3,226 \text{ kW}$$

$$P_3 = \frac{U^2}{R_3} = \frac{220^2}{20} = 2,42 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 + P_3 = 4,84 + 3,226 + 2,42 = \underline{\underline{10,49 \text{ kW}}}$$

Nº 5.3.1.18

$$P_1 = \frac{U^2}{R} = \frac{220^2}{50} = 0,986 \text{ kW}$$

$$P_2 = U \cdot I = 220 \cdot 9 = 1,76 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 + P_3 = 0,986 + 1,76 + 5,6 = \underline{\underline{8,346 \text{ kW}}}$$

Nº 5.3.1.19

$$P_1 = U \cdot I \cdot \cos \varphi = 220 \cdot 12 \cdot 0,8 = 2,12 \text{ kW}$$

$$P_2 = S \cdot \cos \varphi = 3,2 \cdot 0,7 = 2,24 \text{ kW}$$

$$P_3 = 1,2 \text{ kW}$$

$$P_{\text{tot.}} = P_1 + P_2 + P_3 = 2,12 + 2,24 + 1,2 = \underline{\underline{5,56 \text{ kW}}}$$

Nº 5.3.1.20

$$P = P_1 + P_2 + P_3 = 1,2 + 2,4 + 3 = \underline{\underline{6,6 \text{ kW}}}$$

Nº 5.3.1.21

$$P_1 = \frac{U^2}{R_1} = \frac{392^2}{25} = 6,15 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{392^2}{40} = 3,84 \text{ kW}$$

$$P_3 = \frac{U^2}{R_3} = \frac{392^2}{35} = 4,39 \text{ kW}$$

$$P_{\text{tot}} = P_1 + P_2 + P_3 = 6,15 + 3,84 + 4,39 = \underline{\underline{14,38 \text{ kW}}}$$

Nº 5.3.1.22

$$P_1 = \frac{U^2}{R_1} = \frac{395^2}{20} = 7,8 \text{ kW}$$

$$P_2 = \frac{U^2}{R_2} = \frac{395^2}{40} = 3,9 \text{ kW}$$

$$P_3 = \frac{U^2}{R_3} = \frac{395^2}{50} = 3,12 \text{ kW}$$

$$P_{\text{tot}} = P_1 + P_2 + P_3 = 7,8 + 3,9 + 3,12 = \underline{\underline{14,82 \text{ kW}}}$$

Nº 5.3.1.23

$$P_1 = S \cdot \cos \varphi = 1 \cdot 0,85 = 0,85 \text{ kW}$$

$$P_2 = 1,2 \text{ kW}$$

$$P_{\text{f}} = P_1 + P_2 = 0,85 + 1,2 = \underline{\underline{2,05 \text{ kW}}}$$

Nº 5.3.1.24

$$P_1 = U \cdot I = 378 \cdot 12 = 4,536 \text{ kW}$$

$$P_2 = \frac{U^2}{R} = \frac{378^2}{16} = 8,93 \text{ kW}$$

$$P_3 = 3 \text{ kW}$$

$$P_{\text{f}} = P_1 + P_2 + P_3 = 4,536 + 8,93 + 3 = \underline{\underline{16,47 \text{ kW}}}$$

Nº 5.3.1.85

$$I_{\text{moyen}} = \frac{237 + 183 + 207}{3} = 209 \text{ A}$$

a) $S = U \cdot I \cdot \sqrt{3} = 10400 \cdot 209 \cdot 1.73 = \underline{\underline{3,764 \text{ MVA}}}$

b) $P = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi = 10400 \cdot 209 \cdot 1.73 \cdot 0,92 = \underline{\underline{3,463 \text{ MW}}}$

Nº 5.3.1.86

a) $P = \frac{U^2 \cdot z}{R} = \frac{380^2}{40} \cdot 3 = \underline{\underline{10,83 \text{ kW}}}$

$$P_1 = \frac{U^2}{R} \cdot 2 = \frac{380^2}{40} \cdot 2 = 7,20 \text{ kW}$$

$$P_2 = \frac{U^2}{R} \cdot 3 = \frac{380^2}{30} = 4,81 \text{ kW}$$

b) $P_{\text{tot.}} = P_1 + P_2 = 7,20 + 4,81 = \underline{\underline{12,03 \text{ kW}}}$

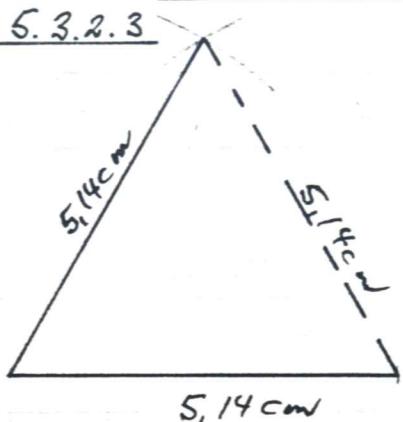
N° 5.3.2.1

$$I = \frac{P}{U} = \frac{150}{220} = \underline{\underline{0,681 A}}$$

N° 5.3.2.2

$$P = (6 \cdot 60) + (2 \cdot 100) + 1200 = 1760 W$$

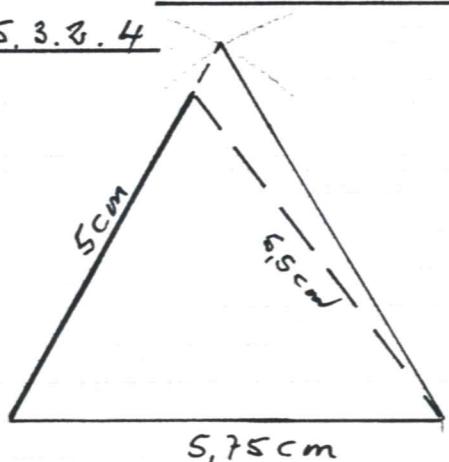
$$IN = I_{ph} = \frac{P}{U} = \frac{1760}{220} = \underline{\underline{8 A}}$$

N° 5.3.2.3

$$P = \frac{P}{2} = \frac{24 \cdot 50}{2} = 600 W$$

$$I = \frac{P}{U \cdot \cos \alpha} = \frac{600}{220 \cdot 0,83} = \underline{\underline{5,146 A}}$$

$$1A = 1cm \Rightarrow 5,146 cm = \underline{\underline{5,14 A}}$$

N° 5.3.3.4

$$P(R+N) = 1,5 + 1,8 = 3,3 kW$$

$$P(T+N) = 1,8 + 2 = 3,8 kW$$

$$a) IR = \frac{P}{U} = \frac{3300}{220} = 15 A = 5 cm$$

$$b) IT = \frac{P}{U} = \frac{3800}{220} = 17,27 A = 5,75 cm$$

$$c) 3A = 1cm \Rightarrow 5,5 cm = \underline{\underline{16,5 A}}$$

d) Non

N° 5.3.2.5

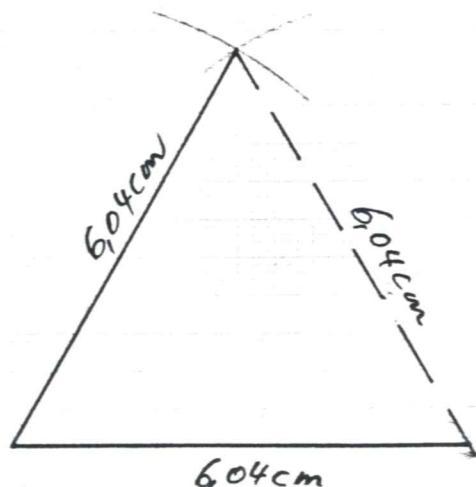
a) $IN = 0 A$ Charges équilibrées !

b) Non

$$c) I = \frac{P}{U} = \frac{1330}{220} = 6,04 A$$

$$1A = 1cm$$

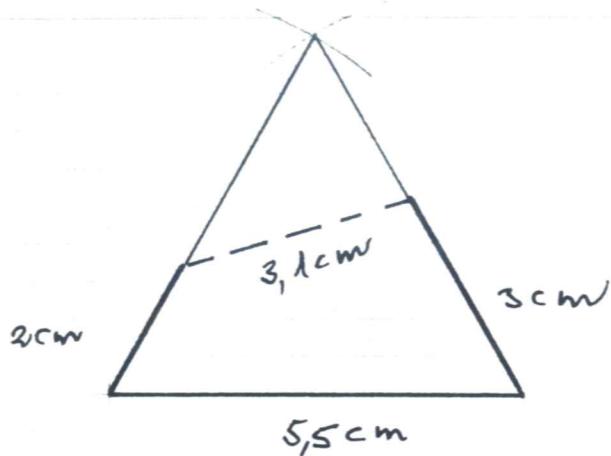
$$6,04 cm = \underline{\underline{6,04 A}}$$



Nº 5.3.2.6

$$2A = 1\text{cm}$$

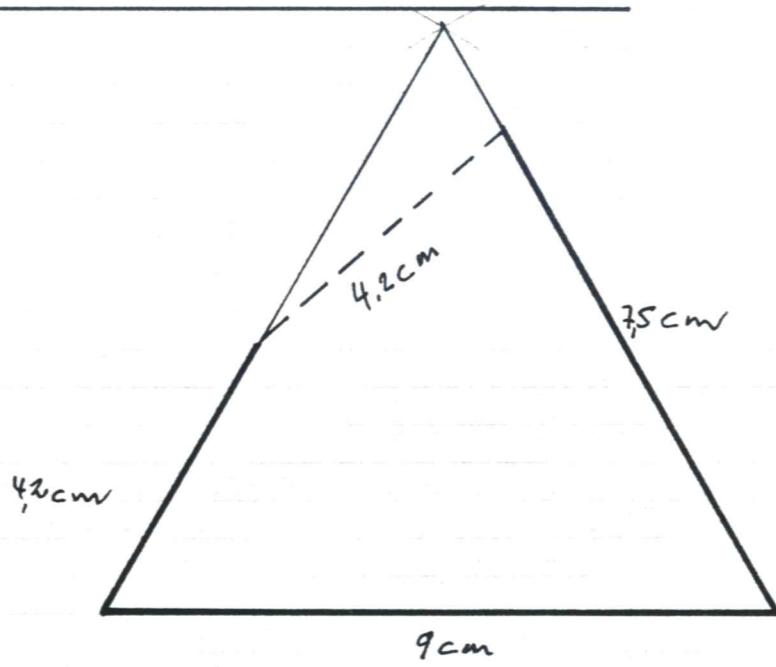
$$IN \ 3,1 \cdot 2 = \underline{\underline{6,2\text{ A}}}$$



Nº 5.3.2.7

$$10A = 1\text{cm}$$

$$IN = 4,2\text{ cm} = \underline{\underline{42\text{ A}}}$$



Nº 5.3.2.8

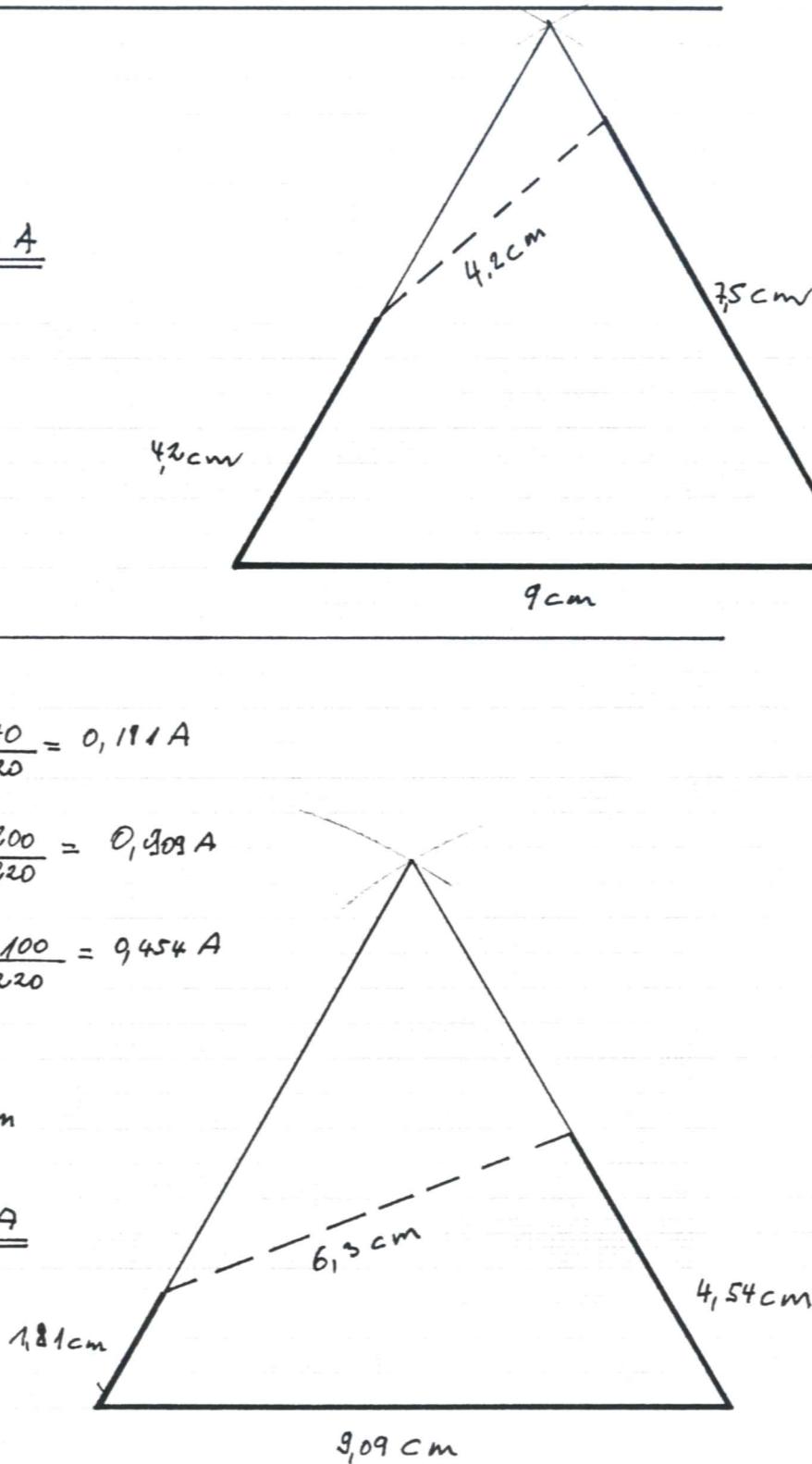
$$IR = \frac{P}{U} = \frac{40}{220} = 0,181\text{ A}$$

$$IS = \frac{P}{U} = \frac{200}{220} = 0,909\text{ A}$$

$$IT = \frac{P}{U} = \frac{100}{220} = 0,454\text{ A}$$

$$0,1\text{ A} = 1\text{cm}$$

$$IN = 6,3\text{ cm} = \underline{\underline{0,63\text{ A}}}$$



N° 5.4.1

$$P_{\text{élément}} = \frac{P}{3} = \frac{28,7}{3} = 9,56 \text{ kW}$$

$$U_{\text{Ph}} = \frac{U}{\sqrt{3}} = \frac{380}{\sqrt{3}} = 219,39 \text{ V}$$

$$R = \frac{U^2}{P} = \frac{219,39}{9,566} = 5,031 \Omega$$

$$Z = R \cdot z = 5,031 \cdot 2 = 10,062 \Omega$$

$$a) = b) = \frac{U^2}{R} = \frac{380^2}{10,062} = \underline{\underline{14,35 \text{ kW}}}$$

$$c) \text{ Rapport} = \frac{28,7}{14,35} = \underline{\underline{\frac{2}{1}}}$$

N° 5.4.2

$$P_{\text{élément}} = \frac{P}{3} = \frac{48}{3} = 16 \text{ kW}$$

$$R = \frac{U^2}{P} = \frac{220^2}{16000} = 3,025 \Omega$$

$$a) = b) = \text{Nelle } P = \frac{U^2 \cdot z}{R} = \frac{220^2}{3,025} \cdot 2 = \underline{\underline{32 \text{ kW}}}$$

$$c) \text{ Rapport} = \frac{P}{P} = \frac{48}{32} = \underline{\underline{\frac{3}{2}}}$$

N° 5.4.3

$$P_{\text{élément}} = \frac{P}{3} = \frac{24}{3} = 8000 \text{ W}$$

$$R = \frac{U^2}{P} = \frac{380^2}{8000} = 18,05 \Omega$$

$$R_{\text{e}} = \frac{1}{R+R} + \frac{1}{R} = \frac{1}{36,1} + \frac{1}{18,05} = 12,033 \Omega$$

$$a) \text{ Nelle } P = \frac{U^2}{R} = \frac{380^2}{12,033} = \underline{\underline{12 \text{ kW}}}$$

$$b) \text{ Nelle } P = \frac{U^2}{R} \cdot z = \frac{380^2}{18,05} \cdot 2 = \underline{\underline{16 \text{ kW}}}$$

$$c) \text{ Rapport} = \frac{P}{P} = \frac{24}{12} = \underline{\underline{\frac{2}{1}}}$$

$$d) \text{ Rapport} = \frac{P}{P} = \frac{24}{16} = \underline{\underline{\frac{3}{2}}}$$

Nº 5.4.4

$$P = \frac{U^2}{R} = \frac{220^2}{80} = 605 \text{ W}$$

$$\text{a)} \quad I = \frac{P}{U} = \frac{605}{220} = \underline{\underline{2,75 \text{ A}}}$$

$$\text{b)} \quad P = \frac{U^2}{R+R} = \frac{380^2}{80+80} = \underline{\underline{908,5 \text{ W}}}$$

$$\text{c)} \quad U_{R_1} = U_{R_2} = \frac{U}{2} = \frac{380}{2} = \underline{\underline{190 \text{ V}}}$$

$$U_{R_3} = \underline{\underline{0 \text{ V}}}$$

$$I_{R_1} = I_{R_2} = \frac{P}{U} = \frac{908,5}{380} = \underline{\underline{2,375 \text{ A}}}$$

$$I_{R_3} = \underline{\underline{0 \text{ A}}}$$

Nº 5.4.5

$$\text{a)} \quad U_{Ph} = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = \underline{\underline{220 \text{ V}}}$$

$$I = \frac{U}{R} = \frac{220}{12,5} = \underline{\underline{17,55 \text{ A}}}$$

$$P = R \cdot I^2 \cdot 3 = 12,5 \cdot 17,55^2 \cdot 3 = \underline{\underline{11,55 \text{ kW}}}$$

$$\text{b)} \quad P = R \cdot I^2 \cdot 2 = 12,5 \cdot 17,55 \cdot 2 = \underline{\underline{7,701 \text{ kW}}}$$

$$I_{R_1} = I_{R_3} = \frac{U}{R} = \frac{380}{12,5} = \underline{\underline{30,4 \text{ A}}}$$

$$I_{R_2} = \underline{\underline{0 \text{ A}}}$$

$$U_{R_1} = U_{R_3} = \frac{U}{\sqrt{3}} = \frac{380}{1,73} = \underline{\underline{220 \text{ V}}}$$

$$U_{R_2} = \underline{\underline{0 \text{ V}}}$$

Nº 5.4.6

$$\text{a)} \quad P = \frac{U^2}{R} \cdot 3 = \frac{220^2}{42} \cdot 3 = \underline{\underline{3,457 \text{ kW}}}$$

$$\text{b)} \quad P = \frac{U^2}{R} \cdot 2 = \frac{220^2}{42} \cdot 2 = \underline{\underline{2,304 \text{ kW}}}$$

$$\text{c)} \quad I_{R_2} = I_{R_3} = \frac{U}{R} = \frac{220}{42} = \underline{\underline{5,23 \text{ A}}}$$

$$I_{R_1} = \underline{\underline{0 \text{ A}}}$$

Nº 5.4.6 Suite

$$U_{R_1} = U_{R_2} = U_{R_3} = \underline{220 \text{ V}}$$

d) $I_R = I_S = \underline{5,23 \text{ A}}$

$$IT = I \cdot \sqrt{3} = 5,23 \cdot 1,73 = \underline{9,072 \text{ A}}$$

Nº 5.4.7

a) $P = \frac{P \cdot 2}{3} = \frac{12 \cdot 2}{3} = \underline{8 \text{ kvar}}$

b) $I_{Ph} = \frac{Q_{Ph}}{U_{Ph}} = \frac{4000}{380} = \underline{10,52 \text{ A}}$

$$U = \underline{380 \text{ V}}$$

c) $I = I_{Ph} \cdot \sqrt{3} = 10,52 \cdot 1,73 = \underline{18,23 \text{ A}}$

d) $I_R = IT = \frac{Q}{U} = \frac{4000}{380} = \underline{10,52 \text{ A}}$

$$I_S = I_{Ph} \cdot \sqrt{3} = 10,52 \cdot 1,73 = \underline{18,23 \text{ A}}$$

Nº 5.4.8

Rapport de $P = \frac{P}{P} = \frac{9}{6} = \underline{\underline{\frac{3}{2}}}$

d'où Rupture d'une des 3 phases ! en Δ !

Nº 5.4.9

en triphasé symétrique tant en Y qu'en Δ
si il manque une phase la P devient
la moitié de P nominale!

donc $P = P \cdot 2 = 8 \cdot 2 = \underline{16 \text{ kW}}$

Nº 5.5.1

$$a) P = P \cdot Z = 1,2 \cdot 2 = \underline{\underline{2,4 \text{ kW}}}$$

$$b) R = \frac{U^2}{P} \cdot 2 = \frac{220^2}{1200} \cdot 2 = \underline{\underline{90,66 \Omega}}$$

$$\text{Nelle } P = \frac{U^2}{R} = \frac{380^2}{80,66} = \underline{\underline{1,79 \text{ kW}}}$$

$$c) U = \frac{U}{Z} = \frac{380}{2} = \underline{\underline{190 \text{ V}}}$$

Nº 5.5.2

$$R_1 = \frac{U^2}{P} = \frac{220^2}{1500} = 32,26 \Omega$$

$$R_2 = \frac{U^2}{P} = \frac{220^2}{1800} = 26,88 \Omega$$

$$R_t = R_1 + R_2 = 32,26 + 26,88 = 59,15 \Omega$$

$$I = \frac{U}{R} = \frac{380}{59,15} = 6,424 \text{ A}$$

$$a) U = R \cdot I = 32,26 \cdot 6,424 = \underline{\underline{207,3 \text{ V}}}$$

$$P = R \cdot I^2 = 32,26 \cdot 6,424^2 = \underline{\underline{1,332 \text{ kW}}}$$

$$b) U = R \cdot I = 26,88 \cdot 6,424 = \underline{\underline{172,7 \text{ V}}}$$

$$P = R \cdot I^2 = 26,88 \cdot 6,424^2 = \underline{\underline{1,109 \text{ kW}}}$$

Nº 5.5.3

$$R_1 = \frac{U^2}{P} = \frac{220^2}{1000} = 48,4 \Omega$$

$$R_2 = \frac{U^2}{P} = \frac{220^2}{1500} = 32,26 \Omega$$

$$R_{\text{tot}} = R_1 + R_2 = 48,4 + 32,26 = 80,66 \Omega$$

$$\text{Nelle } P = \frac{U^2}{R} = \frac{380^2}{80,66} = \underline{\underline{1,79 \text{ kW}}}$$

Nº 5.5.4

a) $I = \frac{U}{R} = \frac{220}{40} = \underline{\underline{5,5 A}}$

$$P = \frac{U^2}{R} = \frac{220^2}{40} = \underline{\underline{1,21 kW}}$$

b) $I = \frac{U}{R} = \frac{220}{50} = \underline{\underline{4,4 A}}$

$$P = \frac{U^2}{R} = \frac{220^2}{50} = \underline{\underline{968 W}}$$

c) $I = \frac{U}{R_1 + R_2} = \frac{380}{40+50} = \underline{\underline{4,2 A}}$

$$P = R \cdot I^2 = 40 \cdot 4,2^2 = \underline{\underline{713,1 W}}$$

d) $I = \frac{U}{R_1 + R_2} = \frac{380}{40+50} = \underline{\underline{4,2 A}}$

$$P = R \cdot I^2 = 50 \cdot 4,2^2 = \underline{\underline{891,3 W}}$$
