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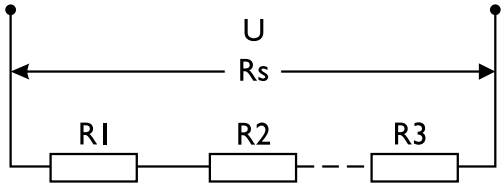
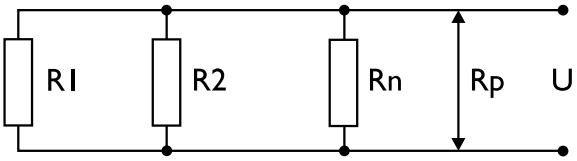
CONNECTIONS OF RESISTANCES

Connection in series



$Rs = R1 + R2 + \cdots Rn$

Connection in parallel



$$\frac{1}{Rp} = \frac{1}{R1} + \frac{1}{R2} \cdots + \frac{1}{Rn} \quad Rp = \frac{R1 \times R2}{R1 + R2} \text{ (2 elements)}$$

Connection of equal resistances				
	Connection in series	Connection in parallel	Example of 2 resistances 52.9 U=230 V	
			Connection in series	Connection in parallel
Resistance	Rs=n R1	$Rp = \frac{R1}{n}$	Rs = 2 x 52.9 = 105.8	$Rp = \frac{52.9}{2} = 26.45$
Power	$Ps = \frac{U^2}{n\ R1}$	$Pp = \frac{U^2 n}{R1}$	$Ps = \frac{230^2}{2x52.9} = 500\ W$	$Pp = \frac{230^2 \times 2}{52.9} = 500\ W$
			250 W resistance	1000 W resistance
Relation-ship	$\frac{Ps}{Pp} = \frac{1}{n^2}$	$Pr = n^2 Ps$	$Pp = 2^2 \times Ps = 4 \times Ps$	

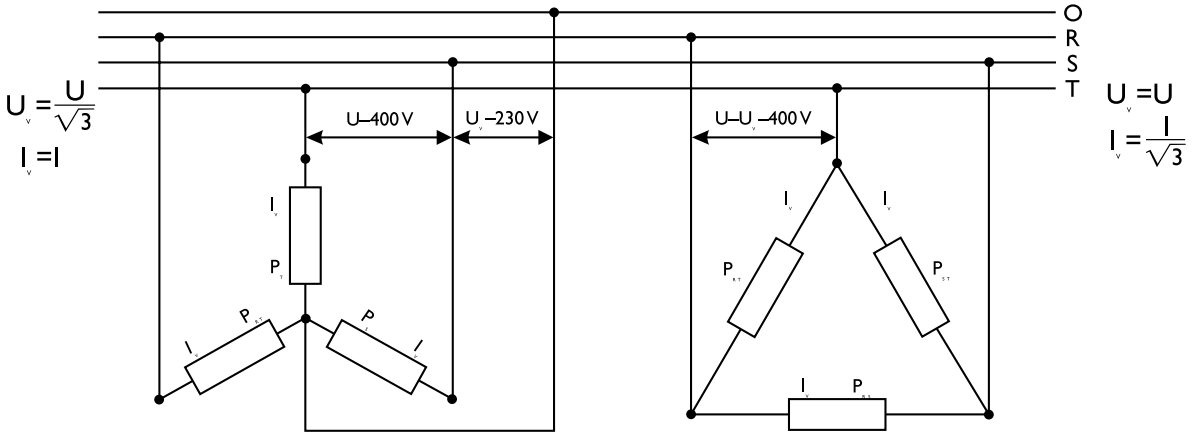
Power at different voltages

E.g. 400 V instead of 230 V

$$P_1 = \frac{U_1^2}{R_1} \quad P_2 = \frac{U_2^2}{R_1} \quad ; \frac{P_1}{P_2} = \frac{U_1^2}{U_2^2} \quad P_2 = \frac{U_2^2}{U_1^2} \times P_1 \quad P_2 = \frac{400^2}{230^2} \times P_1 = 3 \times P_1$$

Star and delta connections with 3-phase systems. Phases equally loaded

Star connection Y 400/230 V



$$P_R = P_S = P_T = \frac{U_V^2}{R}$$

$$P_Y = P_R + P_S + P_T$$

$$P_Y = \frac{3U_V^2}{R} = \frac{U^2}{R}$$

$$P_Y = U_V I = \sqrt{3}\, UI (\cos\varphi = 1)$$

$$I_Y = \frac{1}{3U_V} P_Y$$

$$I_Y\,(A) = 1{,}52 \times P_Y\,(kW)$$

$$P_D = 3 \times P_Y$$

$$I = \frac{1}{\sqrt{3}\, U} P \ (\cos\varphi = 1)$$

$$I\,(A) = 1{,}52\ P\,(kW)$$

Delta connection D 400 V

$$U_v = U \qquad I_v = \frac{I}{\sqrt{3}}$$

$$P_{RS} = P_{ST} = P_{TR} = \frac{U^2}{R}$$

$$P_D = P_{RS} + P_{ST} + P_{TR}$$

$$P_D = \frac{3U^2}{R}$$

$$P_D = 3UI_V = \sqrt{3}\, UI \ (\cos\varphi = 1)$$

$$I_V = \frac{1}{3U} P_D$$

$$I_V\,(A) = 0{,}88 \times P_D\,(kW)$$