2.4 Resistansens temperaturavhengighet

2.4.1

$$R_{t2} = R_{t1}[1 + \alpha (t_2 - t_1)]$$

$$R_{t2} = 100\,\Omega\,[1 + 0{,}004\,K^{-1}(75°C - 20°C)]$$

$$R_{t2} = \underline{122\,\Omega}$$

2.4.3

$$R_{t2} = R_{t1}[1 + \alpha (t_2 - t_1)]$$

$$R_{t2} = 30\,\Omega\,[1 + 0{,}004\,K^{-1}(150°C - 20°C)]$$

$$R_{t2} = \underline{45{,}6\,\Omega}$$

2.4.4

$\alpha = ?$

$$R_{t2} = R_{t1}[1 + \alpha (t_2 - t_1)]$$

$$1 + \alpha (t_2 - t_1) = \frac{R_{t2}}{R_{t1}}$$

$$\alpha (t_2 - t_1) = \frac{R_{t2}}{R_{t1}} - 1$$

$$\alpha = \frac{\frac{R_{t2}}{R_{t1}} - 1}{t_2 - t_1} = \frac{\frac{59{,}5\,\Omega}{50\,\Omega} - 1}{70°C - 20°C} = \underline{0{,}0038\,K^{-1}}$$

2.4.5

$$R_{t2} = \frac{U}{I} = \frac{230V}{1{,}5A} = \underline{153{,}3\,\Omega}$$

$$R_{t2} = R_{t1}[1 + \alpha (t_2 - t_1)]$$

$$153{,}3\,\Omega = R_{t1}[1 + 0{,}0009\,K^{-1}(120°C - 20°C)]$$

$$153{,}3\,\Omega = R_{t1} \cdot 1{,}09$$

$$R_{t1} = \frac{153{,}3\,\Omega}{1{,}09} = \underline{140{,}6\,\Omega}$$

2.4.6

$\alpha = 0{,}0048\ K^{-1}$

$R_{t1} = 70\ \Omega$

$t_1 = 20°C$

$R_{t2} = 100\ \Omega$

$t_2 = ?$

$$R_t = R_{t1}[1 + \alpha(t_2 - t_1)]$$

$$100\ \Omega = 70\ \Omega[1 + 0{,}0048 K^{-1}(t_2 - 20°C)]$$

$$\frac{100\ \Omega}{70\ \Omega} = 1 + 0{,}0048 K^{-1} \cdot t_2 - 0{,}096$$

$$\frac{1{,}43 - 1 + 0{,}096}{0{,}0048\ K^{-1}} = t_2$$

$$t_2 = \underline{\underline{109.3\ °C}}$$

2.4.7

$\alpha = 0{,}0045\ K^{-1}$

$R_{t1} = 120\ \Omega$

$t_1 = 70°C$

$R_{t2} = 150\ \Omega$

$t_2 = ?$

$$R_{t2} = R_{t1}[1 + \alpha(t_2 - t_1)]$$

$$\frac{R_{t2}}{R_{t1}} = 1 + \alpha(t_2 - t_1)$$

$$\frac{R_{t2}}{R_{t1}} - 1 = \alpha \cdot t_2 - \alpha \cdot t_1$$

$$-\alpha \cdot t_2 = \frac{R_{t2}}{R_{t1}} + 1 - \alpha \cdot t_1 \quad /\cdot(-1)$$

$$t_2 = \frac{\frac{R_{t2}}{R_{t1}} - 1 + \alpha \cdot t_1}{\alpha}$$

$$t_2 = \frac{\frac{150\ \Omega}{120\ \Omega} - 1 + (0{,}0045 K^{-1} \cdot 70°C)}{0{,}0045 K^{-1}} = \underline{\underline{12{,}6°C}}$$

2.4.8

a) $R = \frac{\varrho \cdot l}{A} = \frac{0{,}0175\ \Omega \cdot mm^2/m \cdot 220\ m}{1{,}5\ mm^2} = \underline{\underline{2{,}57\ \Omega}}$

b) $R_{t2} = R_{t1}[1 + \alpha(t_2 - t_1)] = 2{,}57\ \Omega[1 + 0{,}0038 K^{-1}(50°C - 20°C)] = \underline{\underline{2{,}86\ \Omega}}$

c) $I_{t1} = \frac{U}{R_{t1}} = \frac{230V}{2{,}57\ \Omega} = \underline{\underline{89{,}5A}}$ $\quad I_{t2} = \frac{U}{R_{t2}} = \frac{230V}{2{,}86\ \Omega} = \underline{\underline{80{,}4A}}$