



Electric Heating Formulas

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List of 14 Electric Heating Formulas

Electric Heating 🕑

Dielectric Heating 🕑

1) Capacitance Dielectric 🕑

$$\mathbf{\hat{c}_{d}} = rac{\mathbf{\epsilon_{r}} \cdot 8.85 \cdot 10^{-12} \cdot \mathrm{A}}{4 \cdot \pi \cdot \mathrm{t_{d}}}$$

$$\mathbf{ex} \left[0.700144 \mu \mathrm{F} = \frac{3.14 \cdot 8.85 \cdot 10^{-12} \cdot 13 \mathrm{m}^2}{4 \cdot \pi \cdot 41.06 \mu \mathrm{m}} \right]$$

2) Dielectric Loss 🗹

fx
$$\mathbf{P}_1 = rac{\mathrm{V}^2}{2 \cdot \mathrm{X_c}} \cdot \sin(2 \cdot \Phi)$$

ex
$$45.58028 \mathrm{VA} = rac{(200 \mathrm{V})^2}{2 \cdot 380 \Omega} \cdot \sin(2 \cdot 60^\circ)$$

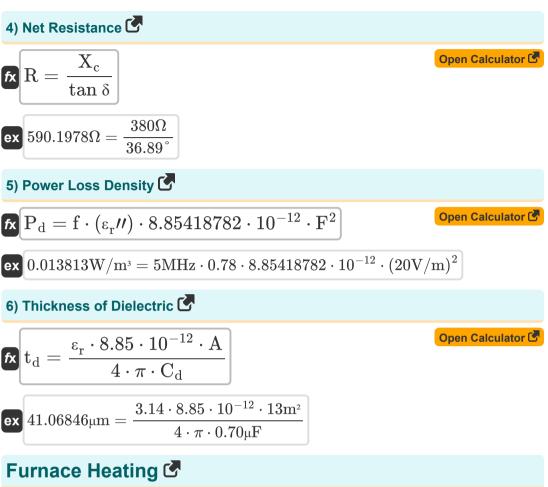
fx
$$\tan \delta = \frac{X_c}{R}$$

ex $36.89049^\circ = \frac{380\Omega}{590.19\Omega}$

Open Calculator

Open Calculator 🗗

Open Calculator 🕑



7) Energy Efficiency 🕑



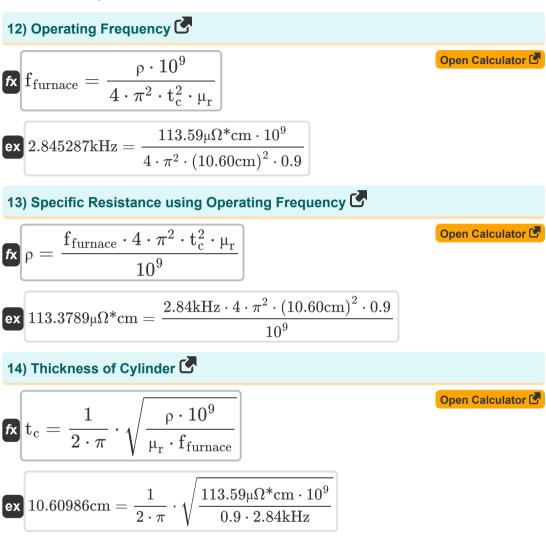


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8) Energy Required by Furnace to Melt Steel Open Calculator fx $\mathbf{E} = (\mathbf{m} \cdot \mathbf{S}_{\text{heat}} \cdot (\mathbf{T}_2 - \mathbf{T}_1)) + (\mathbf{m} \cdot \mathbf{L}_{\text{heat}})$ ex 13.02476KJ = (35.98kg $\cdot 138$ J/(kg*K) $\cdot (299$ K - 300K)) + (35.98kg $\cdot 0.5$ KJ) 9) Equivalent Inductance of Furnace 🖸 $\mathbf{f}_{\mathbf{k}} \mathbf{L} = rac{\pi \cdot 4 \cdot \pi \cdot 10^{-7} \cdot \mathrm{N}_{\mathrm{coil}}^2 \cdot \mathrm{D}_{\mathrm{melt}}^2}{4 \cdot \mathrm{H}_{\mathrm{melt}}}$ Open Calculator 🕑 ex $38.19537 \mu H = \frac{\pi \cdot 4 \cdot \pi \cdot 10^{-7} \cdot (24)^2 \cdot (10.75 cm)^2}{4 \cdot 17.20 cm}$ 10) Heat Conduction 💪 $\mathbf{k} = rac{\mathbf{k} \cdot \mathbf{A}_{\mathrm{furnace}} \cdot \mathbf{T}_{\mathrm{total}} \cdot (\mathbf{T}_1 - \mathbf{T}_2)}{\mathbf{k} \cdot \mathbf{A}_{\mathrm{furnace}} \cdot \mathbf{T}_{\mathrm{total}} \cdot \mathbf{T}_{\mathrm{total}} \cdot \mathbf{T}_{\mathrm{total}}}$ Open Calculator $\mathbf{t}_{\mathbf{m}}$ ex $1.097528W = \frac{11.09W/(m^*K) \cdot 20.5cm^2 \cdot 28s \cdot (300K - 299K)}{100}$ 58cm 11) Heat Radiation Open Calculator $\mathbf{K} \mathbf{H} = 5.72 \cdot \mathbf{e} \cdot \mathbf{K} \cdot \left(\left(\frac{\mathbf{T}_1}{100} \right)^4 - \left(\frac{\mathbf{T}_2}{100} \right)^4 \right)$ $\texttt{ex} \; 3.356142 \mathrm{W/m^{2}*K} = 5.72 \cdot 0.91 \cdot 0.6 \cdot \left(\left(\frac{300 \mathrm{K}}{100} \right)^4 - \left(\frac{299 \mathrm{K}}{100} \right)^4 \right)$









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Variables Used

- A Surface Area (Square Meter)
- Afurnace Area of Furnace (Square Centimeter)
- Cd Capacitance of Dielectric (Microfarad)
- Dmelt Diameter of Melt (Centimeter)
- e Emissivity
- E Energy (Kilojoule)
- **E**_a Actual Energy (*Kilojoule*)
- Et Theoretical Energy (Kilojoule)
- **f** Frequency (Megahertz)
- F Electric Field Strength (Volt per Meter)
- ffurnace Frequency of Induction Furnace (Kilohertz)
- H Heat Radiation (Watt per Square Meter per Kelvin)
- Hmelt Height of Melt (Centimeter)
- **k** Thermal Conductivity (Watt per Meter per K)
- K Radiating Efficiency
- L Inductance (Microhenry)
- Lheat Latent Heat (Kilojoule)
- **M** Mass (Kilogram)
- Ncoil Number of Coil Turns
- Pd Power Density (Watt Per Cubic Meter)
- **P**| Power Loss (Volt Ampere)
- Q Heat Conduction (Watt)
- R Resistance (Ohm)
- Sheat Specific Heat (Joule per Kilogram per K)

- T₁ Temperature of Wall 1 (Kelvin)
- T₂ Temperature of Wall 2 (Kelvin)
- **t**_c Thickness of Cylinder (Centimeter)
- t_d Thickness of Dielectric (Micrometer)
- Ttotal Total Time (Second)
- t_w Thickness of Wall (Centimeter)
- tan δ Loss Tangent (Degree)
- V Voltage (Volt)
- X_c Capacitive Reactance (Ohm)
- ε_r Relative Permittivity
- εr" Complex Relative Permittivity
- **η** Energy Efficiency
- µ_r Relative Permeability
- p Specific Resistance (Microhm Centimeter)
- **Φ** Phase Difference (Degree)



Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288 Archimedes' constant
- Function: **sin**, sin(Angle) *Trigonometric sine function*
- Function: **sqrt**, sqrt(Number) *Square root function*
- Measurement: Length in Micrometer (μm), Centimeter (cm)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg) Weight Unit Conversion
- Measurement: Time in Second (s) Time Unit Conversion
- Measurement: Temperature in Kelvin (K) Temperature Unit Conversion
- Measurement: Area in Square Meter (m²), Square Centimeter (cm²) Area Unit Conversion
- Measurement: Energy in Kilojoule (KJ) Energy Unit Conversion
- Measurement: Power in Volt Ampere (VA), Watt (W) Power Unit Conversion
- Measurement: Angle in Degree (°) Angle Unit Conversion
- Measurement: Frequency in Megahertz (MHz), Kilohertz (kHz) Frequency Unit Conversion
- Measurement: Capacitance in Microfarad (μF)
 Capacitance Unit Conversion
- Measurement: Electric Resistance in Ohm (Ω)
 Electric Resistance Unit Conversion



- Measurement: Inductance in Microhenry (μH)
 Inductance Unit Conversion
- Measurement: Electric Field Strength in Volt per Meter (V/m) Electric Field Strength Unit Conversion
- Measurement: Thermal Conductivity in Watt per Meter per K (W/(m*K)) Thermal Conductivity Unit Conversion
- Measurement: Electric Potential in Volt (V) Electric Potential Unit Conversion
- Measurement: Electric Resistivity in Microhm Centimeter (μΩ*cm)
 Electric Resistivity Unit Conversion
- Measurement: Specific Heat Capacity in Joule per Kilogram per K (J/(kg*K)) Specific Heat Capacity Unit Conversion
- Measurement: Heat Transfer Coefficient in Watt per Square Meter per Kelvin
 (W/m²*K)

Heat Transfer Coefficient Unit Conversion 🖒

• Measurement: Power Density in Watt Per Cubic Meter (W/m³) Power Density Unit Conversion



Check other formula lists

Electric Heating Formulas C

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