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Heat Input in Welding Formulas

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List of 11 Heat Input in Welding Formulas

Heat Input in Welding ↗

1) Heat required to Melt Joint ↗

$$fx \quad H_{req} = M_{fp} \cdot ((C_p \cdot \Delta T_{rise}) + L_f)$$

[Open Calculator ↗](#)

$$ex \quad 8.0475KJ = 0.5kg \cdot ((1.005kJ/kg^{\circ}K \cdot 16K) + 15J/kg)$$

2) Heat Transfer Efficiency ↗

$$fx \quad \alpha = \frac{h_{net}}{H}$$

[Open Calculator ↗](#)

$$ex \quad 0.950119 = \frac{20KJ}{21.05KJ}$$

3) Melting Efficiency ↗

$$fx \quad \beta = \frac{H_{req}}{h_{net}}$$

[Open Calculator ↗](#)

$$ex \quad 0.402375 = \frac{8.0475KJ}{20KJ}$$



4) Net Heat per Unit Volume available for Arc Welding ↗

$$fx \quad h_v = \frac{P_{in}}{v \cdot A}$$

[Open Calculator ↗](#)

ex $167.2727 \text{ J/m}^3 = \frac{46 \text{ W}}{5.5 \text{ mm/s} \cdot 50 \text{ m}^2}$

5) Net Heat Supplied to Joint ↗

$$fx \quad h_v = \alpha \cdot EP \cdot \frac{I}{\beta \cdot v \cdot A}$$

[Open Calculator ↗](#)

ex $167.2405 \text{ J/m}^3 = 0.95 \cdot 20.22 \text{ V} \cdot \frac{.9577 \text{ A}}{0.4 \cdot 5.5 \text{ mm/s} \cdot 50 \text{ m}^2}$

6) Power given Electric Current and Resistance ↗

$$fx \quad P = I^2 \cdot R$$

[Open Calculator ↗](#)

ex $66.15 \text{ W} = (2.1 \text{ A})^2 \cdot 15 \Omega$

7) Power given Electric Potential Difference and Electric Current ↗

$$fx \quad P = V \cdot I$$

[Open Calculator ↗](#)

ex $66.15 \text{ W} = 31.5 \text{ V} \cdot 2.1 \text{ A}$



8) Power given Electric Potential Difference and Resistance ↗

$$fx \quad P = \frac{\Delta V^2}{R_p}$$

[Open Calculator ↗](#)

$$ex \quad 66.16296W = \frac{(18V)^2}{4.897\Omega}$$

9) Rated Duty Cycle given Actual Duty Cycle ↗

$$fx \quad D_{\text{rated}} = D_{\text{req}} \cdot \left(\frac{I_{\text{max}}}{I_r} \right)^2$$

[Open Calculator ↗](#)

$$ex \quad 1.016296 = 0.42 \cdot \left(\frac{7A}{4.5A} \right)^2$$

10) Required Duty cycle for arc welding ↗

$$fx \quad D_{\text{req}} = D_{\text{rated}} \cdot \left(\frac{I_r}{I_{\text{max}}} \right)^2$$

[Open Calculator ↗](#)

$$ex \quad 0.417398 = 1.01 \cdot \left(\frac{4.5A}{7A} \right)^2$$

11) Total heat generated in resistance welding ↗

$$fx \quad H = k \cdot i_o^2 \cdot R \cdot t$$

[Open Calculator ↗](#)

$$ex \quad 21.05013KJ = 0.84655 \cdot (0.7A)^2 \cdot 18.7950\Omega \cdot 0.75h$$



Variables Used

- **A** Area (Square Meter)
- **C_p** Specific Heat Capacity at Constant Pressure (Kilojoule per Kilogram per K)
- **D_{rated}** Rated Duty Cycle
- **D_{req}** Required Duty Cycle
- **EP** Electrode Potential (Volt)
- **H** Heat Generated (Kilojoule)
- **h_{net}** Net Heat Supplied (Kilojoule)
- **H_{req}** Heat Required (Kilojoule)
- **h_v** Heat Required Per Unit Volume (Joule per Cubic Meter)
- **I** Electric Current (Ampere)
- **I** Electric Current (Ampere)
- **I_{max}** Maximum Current New Add (Ampere)
- **i_o** Input Current (Ampere)
- **I_r** Rated Current (Ampere)
- **k** Constant to Account for Heat Losses
- **L_f** Latent Heat of Fusion (Joule per Kilogram)
- **M_{fp}** Mass in Flight Path (Kilogram)
- **P** Power (Watt)
- **P_{in}** Input Power (Watt)
- **R** Electric Resistance (Ohm)
- **R** Resistance (Ohm)



- R_p Resistance for Power (Ohm)
- β Melting Efficiency
- t Time (Hour)
- v Travel Speed of Electrode (Millimeter per Second)
- V Voltage (Volt)
- α Heat Transfer Efficiency
- ΔT_{rise} Rise in Temperature (Kelvin)
- ΔV Electric Potential Difference (Volt)



Constants, Functions, Measurements used

- **Measurement:** **Weight** in Kilogram (kg)
Weight Unit Conversion 
- **Measurement:** **Time** in Hour (h)
Time Unit Conversion 
- **Measurement:** **Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement:** **Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement:** **Area** in Square Meter (m^2)
Area Unit Conversion 
- **Measurement:** **Speed** in Millimeter per Second (mm/s)
Speed Unit Conversion 
- **Measurement:** **Energy** in Kilojoule (kJ)
Energy Unit Conversion 
- **Measurement:** **Power** in Watt (W)
Power Unit Conversion 
- **Measurement:** **Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement:** **Electric Potential** in Volt (V)
Electric Potential Unit Conversion 
- **Measurement:** **Specific Heat Capacity** in Kilojoule per Kilogram per K ($kJ/kg \cdot K$)
Specific Heat Capacity Unit Conversion 
- **Measurement:** **Latent Heat** in Joule per Kilogram (J/kg)
Latent Heat Unit Conversion 



- **Measurement:** **Energy Density** in Joule per Cubic Meter (J/m^3)

Energy Density Unit Conversion 



Check other formula lists

- Distortion in Weldments
Formulas 
- Heat Flow in Welded Joints
Formulas 
- Heat Input in Welding
Formulas 

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