neptronic®
www.neptronic.com
HVAC Controls | Electric Actuators | Actuated Valves
Humidifiers | Electric Heaters

Head Office
Neptronic®
400 Lebeau Blvd.
Montreal, Quebec, Canada H4N 1R6
Tel.: (514) 333-1433
Fax: (514) 333-3163
Toll Free: 1-800-361-2308

Plug It In

Using Heater Selection Formulas

At times when designing or selecting a heater, the schedule/specifications may not include all the details you need. This article will help calculate the missing details/information to complete the selection process.

The basic information required when selecting a heater is: (a) **VOLTAGE**/ph/Hz; (b) Power in **kW**; (c) **DUCT DIMENSIONS**; (d) **AIRFLOW**. If one of these details is missing, the process of selecting and ordering a heater is incomplete.

(a) Neptronic heaters are custom built as per your selection. If you do not know the **voltage** – do not assume. Please find out the correct voltage before submitting a selection. If the current in amps (*I*) is provided, the kW can be calculated using the formula below. Note that the voltages are with +/- 5% tolerance. Using wrong voltages could damage the heater.

Electric power

Single phase

$$P = V \times I \quad \text{or} \quad P = \frac{V^2}{R}$$

3 phase

$$P = V \times I \times 1.732 \qquad P = \frac{V^2}{R} \times 1.732$$

P : Power in Watts
V : Voltage in Volts
R : Resistance in Ω (Ohm)
I : Current in Amps

Line current

Single phase

$$I = \frac{P}{V}$$

3 phase

$$I = \frac{P}{V \times 1.732}$$

USA
NEP Inc.
P.O. Box 1151
Medford Oregon,
USA 97501
Tel.: (541) 531-5746

Middle East & Asia
NEP International FZE
P.O. Box 125687,
Dubai, UAE
Tel.: +97155 8825487
Fax: +9714 3426772

Singapore
Neptronic Pte Ltd
Office D6, #03-38,
Mountbatten Square
229, Mountbatten Road,
Singapore – 398 007
Mobile: +65 8118 4184
Tel: +65 6650 6212
Fax: +65 6491 6423

(b) Often you may not see the power (***kW***) listed on the schedule. Airflow and temperature rise (*Delta T*) are required to calculate the *kW*. Information could be provided in Imperial or Metric format. Pay attention to plug in your values in the correct formula.

Power or electric heater capacity

Imperial

$$kW = \frac{CFM \times (T°2 - T°1) \times 1.08}{3413}$$

kW : Power in kW
CFM : Air volume in Cubic Feet per Minute
T°2 : Temperature of air leaving heater in ∞F
T°1 : Temperature of air entering heater in ∞F

Metric

$$P = \frac{Q \times (T°2 - T°1) \times 1,21}{3600}$$

P : Power in kW
Q : Air volume in m^3/hour
T∞2: Temperature of air leaving heater in ∞C
T∞1: Temperature of air entering heater in ∞C

Temperature differential $\Delta T = T°2 - T°1$

Imperial

$$\Delta T = \frac{kW \times 3413}{CFM \times 1.08}$$

Metric

$$\Delta T = \frac{P \times 3600}{Q \times 1,21}$$

(c) **Dimensions** are very important to manufacture a heater. Our heaters are custom built to fit any duct size but cannot be field modified if actual duct dimensions are different. Duct area can be calculated using below formulas, but this will only provide a minimum duct size in square feet or square meters based on your kW.

KW per square foot

Imperial

$$kW / pi^2 = \frac{kW}{S}$$

kW : Power in kW
S : Surface area in square feet

Metric

$$kW / m^2 = \frac{P}{S}$$

P : Power in kW
S : Surface area in m^2

Duct area

Imperial

$$S = \frac{W \times H}{144}$$

S : Surface area in square feet
W : Duct width in inches
H : Duct Height in inches

Metric

$$S = W \times H$$

S : Surface area in m^2
W :Duct width in meter
H : Duct height in meter

(d) **AIRFLOW** plays an important role in the selection. Neptronic's heater software selects the appropriate type of heating element (gauge/quantity) based on the airflow that is entered. The same formula used to calculate kW can be used to estimate airflow.

Imperial

$$kW = \frac{CFM \times (T°2 - T°1) \times 1.08}{3413}$$

kW : Power in kW
CFM : Air volume in Cubic Feet per Minute
T°2 : Temperature of air leaving heater in ∞F
T°1 : Temperature of air entering heater in ∞F

Metric

$$P = \frac{Q \times (T°2 - T°1) \times 1,21}{3600}$$

P : Power in kW
Q : Air volume in m^3/hour
T∞2: Temperature of air leaving heater in ∞C
T∞1: Temperature of air entering heater in ∞C

Temperature differential $\Delta T = T°2 - T°1$

Imperial

$$\Delta T = \frac{kW \times 3413}{CFM \times 1.08}$$

Metric

$$\Delta T = \frac{P \times 3600}{Q \times 1,21}$$

Here are some conversions that may help for quick calculations;

Conversions

∞F to ∞C	∞C to ∞F	BTU to kW	kW to BTU
$∞C = \frac{(∞F - 32)}{1.8}$	$∞F = (1.8 \times ∞C) + 32$	1 kW = 3413 BTU/hre	1 BTU/hre = 0.29307×10^{-3} kW
mm to inches	**Inches to mm**	**CFM to FPM**	**FPM to CFM**
1 in = 25.4 mm	1 mm = 0.03937 in	$1 FPM = \frac{1 CFM}{S}$	1 CFM = 1 FPM x S

S : Surface area in square feet

These formulas are there to help you when selecting electric heaters. Use them to your advantage!