DESIGN GUIDELINES

Calculation of power

The following information will assist in the design of elements and rough calculation of data. Optimum power and temperature conditions for specific applications are usually determinated experimentally.

The following formula can be used to determine approximately the required rating P (Power) to heat a given material.

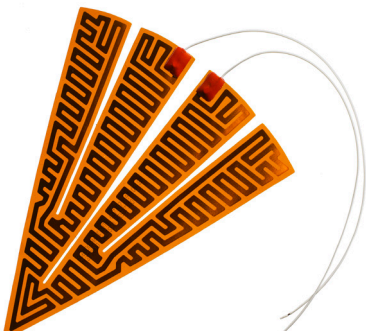
$$P = \frac{\text{Weight of material (g) x Spec.heat (Ws/g °C) x temp. rise °C}}{\text{Time sec}} \quad W$$

Technical specification

Spec. heat and density of common materials:

Material	Spec. heat Ws/g	Density g/cm³)
Aluminum	0.90	2.7
Copper	0.39	8.9
Stainless steel	0.50	8.0
Iron	0.46	7.8
Water	4.18	1.0

Product photo



Temperature control

In conjunction with CALESCO foil heating elements it is usually necessary to arrange some form of control to ensure that the desired temperature is maintained.

This can be achieved with electromechanical thermostats of bimetallic type where temperatures and surface ratings are low, while electronic thermostats are prefered where temperatures and surface loads are high.

We can fit thermostats, temperature fuses and sensors of the thermoelement type, thermistors and resistance sensors directly to element in accordance with customer specifications.

Electrical insulation and leakage current

When a foil element is fitted on or in contact with a metal, surface leakage current must be taken into account. The basic standard for heating appliances is laid down in the rules IEC 335-1, on which various national standards are based.

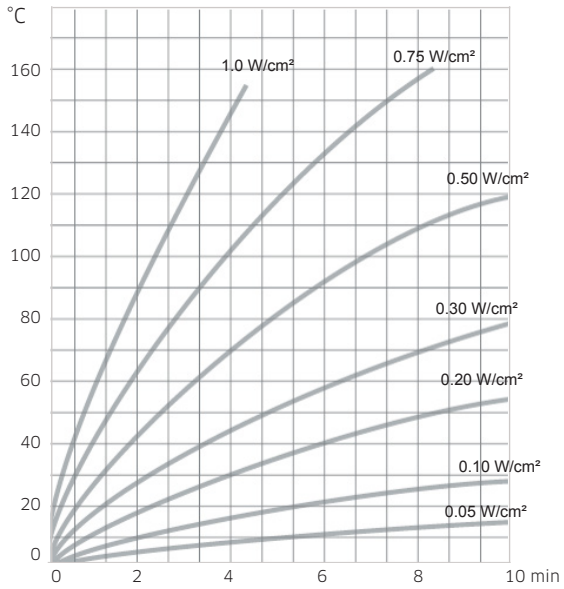
The maximum level of leakage current for Class I (earthed) appliances is 0.75 mA/kW while for Class II (double-insulated) appliances it is 0.25 mA/kW. Medical appliances are subjected to special leakage current restrictions as per IEC 601.

Temperature curves and required power

The diagrams below show temperature rise as a function of time for certain applications and various types of element with different surface rating. Surface rating is defined as the total power divided by the effective area of one side of the element.

Optimum power and temperature conditions for specific applications are usually determinated experimentally.

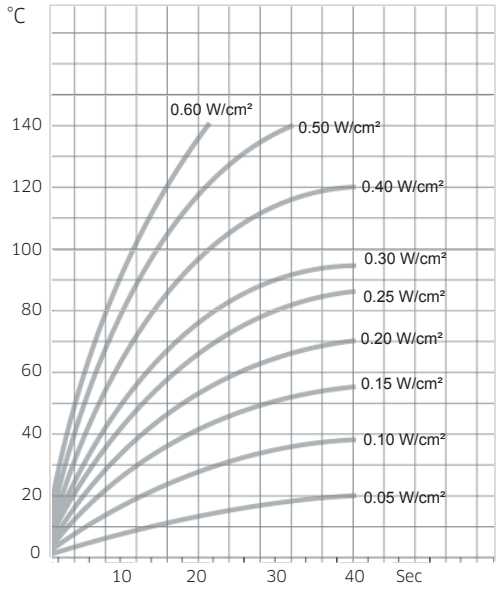
Temperature rise for element mounted on aluminium



Watt density W/cm²	0.05	0.10	0.20	0.30	0.50
Final temp. rise °C	25	45	80	105	160

Foil element mounted on an aluminium plate, 215x155x5 mm, with adhesive and suspended horizontally in free air.

Temperature rise for element alone



Watt density W/cm²	0.05	0.10	0.15	0.20	0.25	0.30	0.40	0.50	0.60
Final temp. rise °C	25	45	60	80	90	105	130	160	175

Foil element, 210x150 mm, suspended horizontally in free air.

Benefits

- Space saver
- Optimized heat distribution
- High/Low wattage
- Custom design
- Cost efficient