

## Infrared Heating

	Page No.
Explanation of Infrared Heating	13.1
Infrared Radiation Heating Elements	13.2
Ceramic Heater selection	13.4
Metal Sheath Infrared Heating	13.5
Comparison of typical performance	13.7

# 13.1

## Infrared Radiation Heating Elements

### Explanation of Infrared Radiant Heating Systems

Infrared heating is a misconceived technology that many feel is difficult and complicated to apply. While this theory can be complicated, it is far easier to apply when guidance and understanding is given on various heating methods best suited to your application.

The main modes of transferring heat are:

#### Convection Heating

Where heat energy is transferred from a higher temperature region in a gas or liquid to a lower temperature region as a result of movement of masses within the gas or liquid, eg. tank or vessel heating.

#### Conduction Heating

Where two masses of different temperatures are brought into contact with each other and heat is transferred from the hotter to the cooler body, eg. plattern heating, extrusion barrels.

#### Radiation Heating

Where Infrared Radiant energy is transported through space by electromagnetic waves without the need of a conductive medium, allowing heat to be delivered in concentrated areas at very fast rates. Electromagnetic radiation is broken down into four categories:

■ Ultraviolet ■ Infrared (Short, Medium and Long wavelength) ■ Microwave ■ Induction

Radiant Infrared heating is used in many industries, such as:

#### Textiles:

- To set nylon & perlon threads
- Drying washed and dyed fabrics

#### Food:

- Baking
- Keeping food warm
- Packaging of food products

#### Plastics & Rubber:

- Thermoforming
- Vacuum forming
- Laminating
- Pre-heating rubber prior to extrusion

#### Miscellaneous Processes:

- Drying & curing of paint & powder coatings
- Ink drying
- Preheating moulds
- Evaporation of water
- Maintaining precise environmental temperatures
- Drying of skins and colour spraying of leather

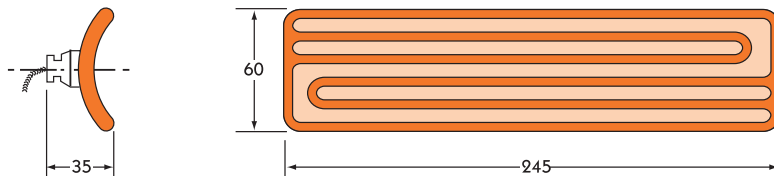
#### Pulp & Paper:

- Adhesive activation
- Drying of pulp paper

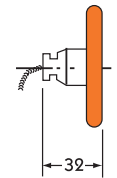
## Infrared Radiation Heating Elements

Voltage 230V, other voltages available

**FSC** (curved version)

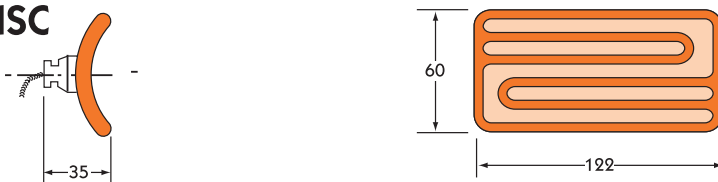


**FSF** (flat version)

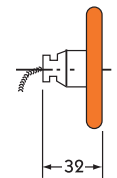


Ratings (watts)	150	250	300	350	400	500	650	750	1000
Mean surface temperature C	235	340	370	400	420	450	520	555	600
Peak wavelength $\mu\text{m}$	5.7	4.7	4.5	4.3	4.1	4	3.6	3.5	3.3

**HSC**

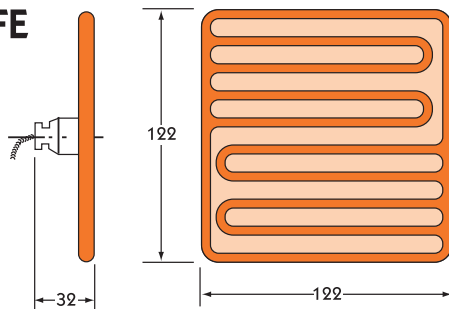


**HSF**

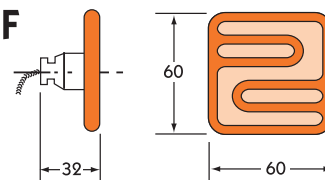


Ratings (watts)	125	150	200	250	325	375	400	500
Mean surface temperature C	340	370	420	450	520	540	570	600
Peak wavelength $\mu\text{m}$	4.7	4.5	4.1	4	3.6	3.5	3.4	3.3

**SFE**



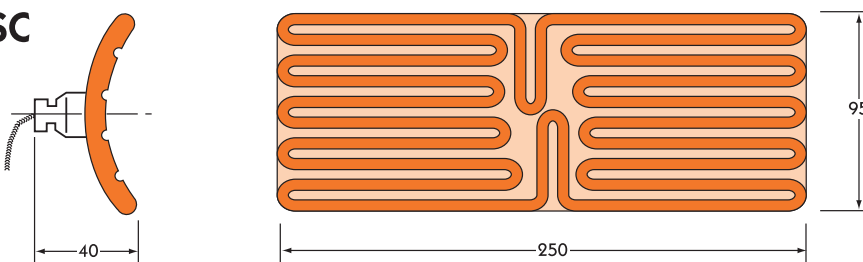
**QSF**



Ratings (watts)	50	150	250
Mean surface temperature C	175	450	590
Peak wavelength $\mu\text{m}$	6.4	4	3.3

Ratings (watts)	150	200	250	300	350	400	500	650	750	1000
Mean surface temperature C	235	300	340	370	400	420	450	520	555	600
Peak wavelength $\mu\text{m}$	5.7	5	4.7	4.5	4.3	4.1	4	3.6	3.5	3.3

**LSC**

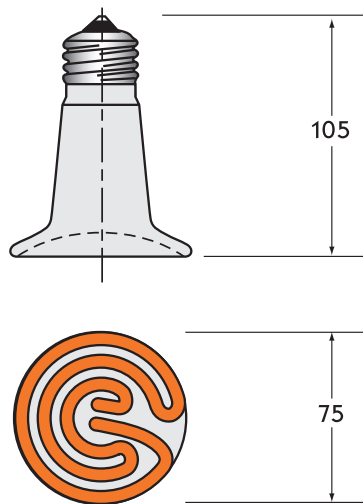


Ratings (watts)	1500
Mean surface temperature C	600
Peak wavelength $\mu\text{m}$	3.3

\*All dimensions in millimetres

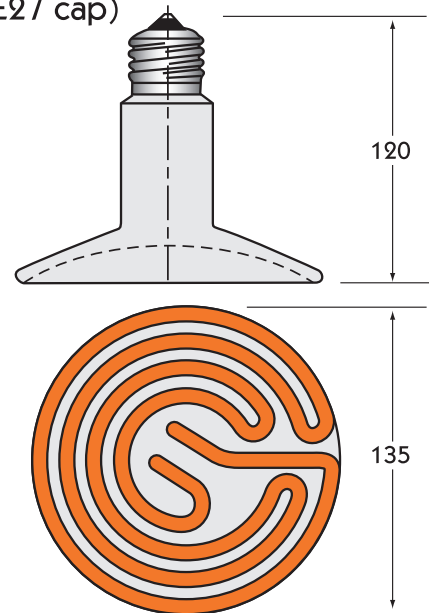
# 13.3

SFL 2 (E27 cap)



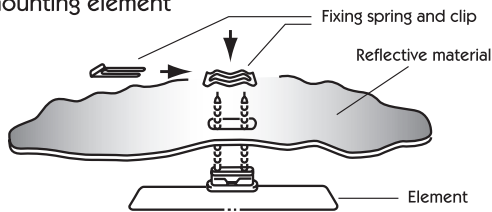
Ratings (watts)	60	75	100
Mean surface temperature C	200	235	275
Peak wavelength $\mu\text{m}$	6.1	5.7	5.3

SFL 1 (E27 cap)

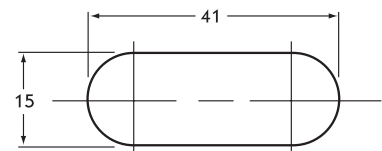


Ratings (watts)	150	250	500
Mean surface temperature C	230	300	480
Peak wavelength $\mu\text{m}$	5.7	5	3.9

Method of mounting element



\*All dimensions in millimetres



Cut out for mounting lug



# 13.5

## Infrared Radiation Heating Elements

### Metal Sheath Infrared Heating

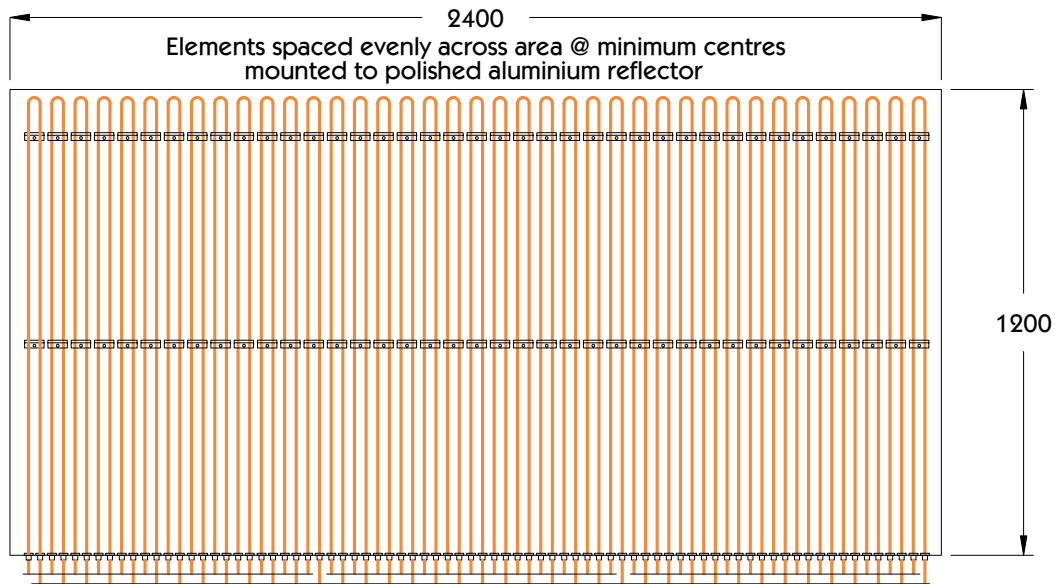
In the past Metal Sheath Infrared Heaters were considered inefficient. Through an extensive research and development program, Thermal can now offer a black radiation Metal Sheathed Infrared heating element, or system, to suit your every need. This is an efficient way of heating which is robust and can handle a vast range of conditions, such as constant splashing and vibration. Special polished units are available, their exceptional cleanliness qualities make them ideal for use in the food processing and dairy products industries. Polished Aluminium or Stainless Steel reflectors are used to reflect 80% of the infrared radiation and help to direct heat in a controlled direction.

Thermal Black Radiation Metal Sheathed Infrared Heaters can be used for:

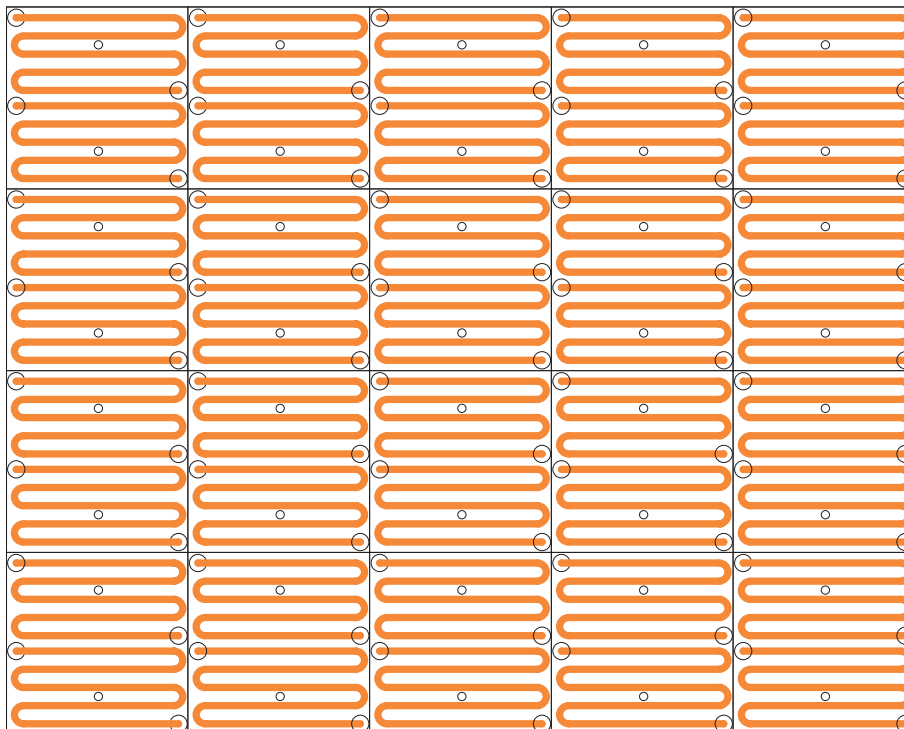
- Curing
- Drying
- Softening of resins, vinyls and plastics
- Baking, drying and curing of paint, lacquers, adhesives and inks
- Vacuum forming
- Drying paint on textiles
- Mass heating
- Comfort heating

# 13.6

## Various Metal Sheathed Infrared Layouts - For maximum efficiency



Element layout for thermoforming machine



# 13.7

## Electromagnetic Spectrum Comparison of Typical Performance of Infrared Heating Elements

Electromagnetic Spectrum	Type of Heater	Wavelength of peak Emission	Temp. of Emitter	Typical Radiant Efficiency	Approx Heat Up Time	Approx Cool Down Time	Resistance to Vibration, Physical & Thermal Shock
0.1µm	<b>Short Wave Quartz tubes</b> Tungsten filament in sealed quartz tube, evacuated or partially filled with halogen/inert gas. Variants have back of tube gold plated; twin tubes; water cooled tubes	0.9 to 1.6µm (1.3µm Typical)	2200°C Typical	80%	2 secs	2 secs	Filament and tube fragile
1.0µm		0.9 to 1.6µm (1.3µm Typical)	2200°C Typical	75 - 80%	2 secs	2 secs	Filament and bulb fragile
10µm		<b>Medium Wave Quartz Tubes</b> Nichrome resistance spiral in unsealed quartz tube. Variants have back of tube gold plated; twin tubes	2.0µm to 3.6µm	1000°C to 750°C	To 70%	30 - 90 secs	10 - 20 secs
100µm	<b>Ceramic Elements</b> Nichrome resistance spiral embedded in fired and glazed hollow ceramic body.	2.9µm to 4.3µm	750°C 400°C	To 90%	4 - 9 mins	10 - 15 mins	Fragile, tolerates water splash
1000µm	<b>Metal Sheathed Elements</b> Nichrome spiral in roll compacted magnesium oxide powder, sheathed in nickel alloy tube.	2.9µm to 5.0µm	780°C 350°C	60%	3 - 8 mins	8 - 12 mins	Very robust. Tolerates water splash

