Radiant heaters

SAVE ENERGY AND MONEY

Like the sun, radiant heaters heat people and objects and thereby increases the temperature comfort and lower the energy losses. This allows the air temperature to be reduced, and thus the cost. With a radiant heater, you can also heat only a selected zone, without heating up the whole premises.

CREATE COMFORT

As radiant heaters do not heat the air directly, they create a soft and comfortable indoor climate and an even temperature without any air movement. Outdoors, radiant heaters are also highly performant, prolonging evenings and the summer season. The temperature can be adapted perfectly in different areas of a room or a terrace.

FIND WHAT YOU NEED

Whether you are looking for a total heating system or a solution for a particular spot, radiant heaters are often the answer. Frico offers a wide range of radiant heaters, electrical and water heated, with applications areas from large industrial premises down to closer use, indoors or outdoors.

Welcome to the Frico radiant heating catalogue and our 85 years of experience in energy efficient heating!

Good reasons to choose Frico

More than 85 years experience in developing products for the varied Nordic climate has provided us with a unique knowledge bank. This is our foundation when creating today's energy efficient solutions for a comfortable indoor climate.

Leading technology and design

Today Frico is the leading supplier of air curtains, radiant heaters and fan heaters in Europe, and the products are designed according to good Scandinavian tradition. As market leaders we run development and offer both electrical and water heated products and also air curtains without heat.

Heating experts

Frico knows heating. The company was founded in 1932 and we introduced our first radiant heater in 1967. Quality has always been a well known characteristic of Frico products, as well as high technical functionality. In 1956 we introduced the final testing in production of all products to ensure that our high quality requirements are met. Regular tests and measurements are made to develop new, but also to improve our existing, products. We are happy to share our knowledge and experience and we are always available to help you choose the right product.

Climate-smart

At Frico, we are proud to be able to offer energy-efficient products for a better indoor climate. In our product development work, the focus is on achieving the greatest possible function with the least possible energy consumption – without compromising on our core values of trust, competence and design.

This means that our products not only manage the local climate in business complexes, industrial buildings, offices or summer cottages; with optimum energy efficiency, we ensure that our products are climate-smart.

Frico's headoffice is located outside Gothenburg in Sweden and we are a part of the Systemair Group. Today Frico is represented in 70 countries world wide either by subsidiaries or distributors. Updated information is always available on our website www.frico.se.

We manufacture at production units in Skinnskatteberg, Sweden and at other ISO-certified production units in Europe. Our warehouses are strategically placed in several places in Europe.

Trust, Competence and Design

You can feel assured with Frico as a partner. We work according to our core values - trust, competence and design - in all aspects, from product development to contact with you the customer. Most of our products are kept in stock, which gives you short delivery times, and our well developed distribution network gives you access to maintenance, service and support. Our experience and knowledge guarantee the best solution for a comfortable indoor climate. And we offer products that can blend in with your environment or can be a design element that stands out.

Qualified local support

Frico is present locally in some 70 countries worldwide with a network of wholly-owned subsidiaries and independent distributors. Our highly qualified representatives are carefully chosen and together we are able to provide you with the best possible support. To find your nearest Frico subsidiary or distributor, please visit www.frico.se.

Frico Academy

Frico Academy is an important platform for networking and sharing inspiration and knowledge between us and our distributors around the world. Through the Frico Academy we share our knowledge on theory and technology, as well as product knowledge and experience in manufacturing and product development.

It is easy to choose Frico

We simplify everyday life by giving you relevant product information together with our knowledge within heating. At www.frico.se you will always find updated information, you can receive help to select the correct product and get inspiration from among our references, see our news, manuals, wiring diagram etc.
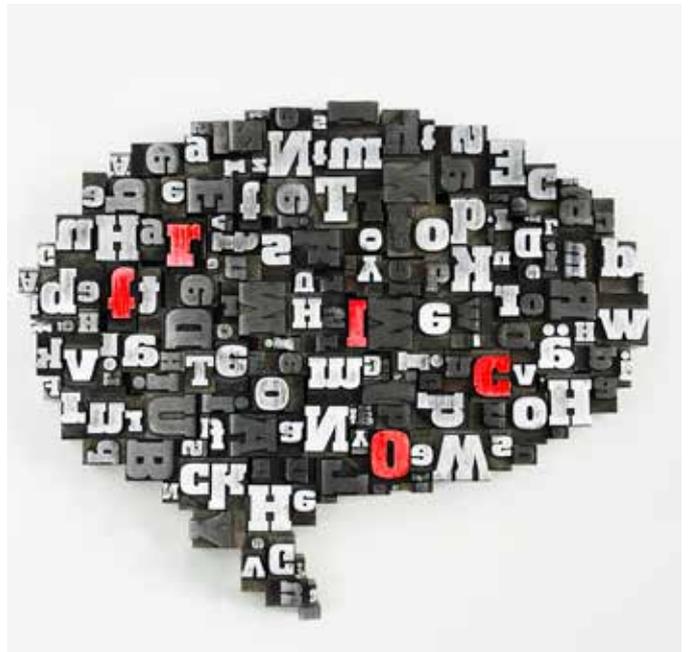
Ecodesign Regulation (EU) 2015/1188 concerning local space heaters does not apply to all application areas.
The Regulation applies when an installation is intended to provide thermal comfort for people in the premises. The Regulation does not apply to heating installations of a more technical nature e.g. in engineering/utility rooms, in production processes, frost protection, etc. The Regulation also does not apply to installations in vehicles, offshore or outdoors.

Many of Frico's products can be used as both local space heaters (as defined in (EU) 2015/1188) and for technical heating purposes. It is up to the installer responsible for the installation to assess whether the Ecodesign Regulation is applicable or not.
Control solutions for installations not covered by the Ecodesign Regulation are listed in a separate table.

Radiant heaters

Frico's radiant heaters heat like the sun. The most magnificent radiant heater is the sun. The heat emitted from this hot source is essential for all life on earth. The infrared rays of the sun can travel a long distance, with a minimal loss of energy. When the infrared rays hit a surface, the energy is converted to heat. Warm objects then heat the surrounding air. Even though the sun is so far away it heats the surface of the earth, while the space in between remains cold. Nature's own way of heating is fantastic! Frico radiant heaters imitate the sun, the most comfortable and economical heat source available.

There are many advantages with radiant heaters:

Economy
- Heat people and objects that, in turn, heat the surrounding air. This allows the temperature to be reduced while maintaining comfort. Lowering of the air temperature by 1 °C gives an energy saving of approx. 5 %.
- Produces instant heat, thus much quicker than traditional heating systems. This is especially useful outdoor and in buildings that are used occasionally such as sport centres and country houses.
- Heat at floor level, not at the ceiling.
- Possibility to heat only a limited area of a large open space.
- Reduced night temperature possible with right controls thanks to quick heat-up time.

Safety
- By positioning the heaters at high level, the risk of getting in contact with the heater is greatly reduced. The heater is also protected against damage.
- Some radiant heaters are ideal for premises with fire risk or highly explosive environments (see radiant heater Aquaztrip).

Simplicity
- Easy and flexible installation.
- Requires a minimum of maintenance.
- User friendly.

Comfort
- Using the radiation principle, air is not heated directly. This results in a soft, draught-free, comfortable indoor climate and an even temperature.
- Does not cause any air movement, as traditional heating systems often do. Reducing the spread of dust, bacteria or odours improves the quality of the indoor environment.
- Spot and zone heating give the right comfort to the right area.

Discreet
- The system is completely silent.
- Mounting on the ceiling or recessed in a false ceiling gives a discreet heating.
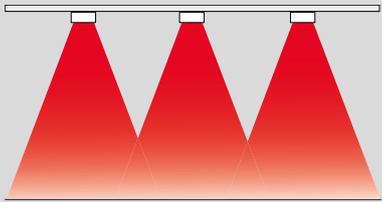
Space
- By putting the heater on the ceiling, valuable wall and floor space is saved.
- Provides cold draught protection so that even the surface closest to the windows can be utilized.

Type of heating

Total heating
Radiant heaters heat people first, then the air is heated indirectly. The operative temperature, being the temperature a person senses, is therefore a little higher than the actual air temperature.

For a specific comfort level, use of a radiant heating system will allow a reduction in air temperature of a couple of degrees when compared to a conventional system, and every degree reduction will reduce energy consumption by approx. 5 %.

Cold draught protection
A cool surface such as a window has a chilling effect on the neighbouring air. Radiant heaters provide efficient and economical protection against cold draughts caused by windows by heating the window's surface. The colder the window, the more radiant heat it will draw. The radiated heat "automatically" migrates to where it is most needed, which facilitates the creation of a comfortable indoor climate.
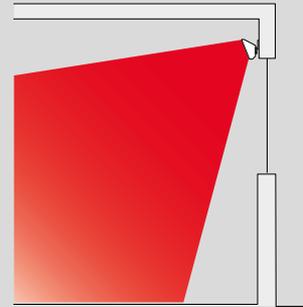
Zone and spot heating
With a radiant heating system, different zones within the same room can have different temperatures. It is therefore possible to divide any area into smaller zones and maintain a different comfort level in each zone.

It is also possible to focus the heat on a certain spot, such as a single workstation. A spot heating application can be controlled much as spot lighting, with the level of heating being increased when needed.

Complementary heating
As addition to other heating systems and when expanding an existing system, radiant heaters are often a simple, inexpensive solution. For a water heated building, putting up a single or a few electrical heaters is often a smoother and more flexible solution than extending the water pipe system.

For more information about the different types of heating, see the Technical handbook.

Choose the right radiant heater

Radiant heaters are available in various designs – it is primarily the installation height, the surrounding environment and the type of heating wanted (see previous page) that determine the choice of product. To acheive good comfort, it is essential to choose the right type of radiant heater.

An infrared heater equipped with halogen lamps at approx. 2000 °C provides intense, short-wave radiation. It is well-suited to outdoor use where wind effects need to be compensated. For a similar but softer heat an infrared heater with tube elements at approx. 750 °C can be used. The heat emitted from these radiant heaters can be compared to the radiant heat felt from an open fireplace.

Thermocassette and Aquaztrip panels, with a large element surface and a surface temperature of approx. 70-100 °C, provide long-wave heat radiation, giving comfortable heating and good dispersion in rooms of normal height.

Elztrip with surface temperature of approx. 320 °C provides middle-wave heat radiation, which makes the unit suitable for several indoor applications, from heating large industrial premises to zone and spot heating.

In order to achieve best heating comfort, a solution with a larger number of heaters with low output is preferable to fewer heaters with high output.

When zone- or spot heating an area, the heaters should be placed so that the heat comes from at least two directions. This is especially important when the heaters are mounted at lower heights.

Below table and the examples on the following pages will help you to choose the right radiant heater.

Our radiant heaters

Type	Heating	Installation height [m]	Output [W]	Surface temp. [°C]	Heating element
Offices, shops and public premises					
Thermoplus	⚡	2–3	300-900	180	Radiant aluminium panel
Thermocassette	⚡	< 3	300-600	100	Heating film
Elztrip EZ100	⚡	2,5–4	600-1500	320	Radiant aluminium panel
Industry and large premises					
Elztrip EZ200	⚡	3–10	800-2200	320	Radiant aluminium panel
Elztrip EZ300	⚡	4–15	3600-4500	320	Radiant aluminium panel
Infrared IR	⚡	4,5–20	3000-6000	700	Infrared heating rod
Infrared IRCF	⚡	3–5	1500-4500	2200[*2]	Halogen lamp
Aquaztrip Plan	💧	< 10	184-511	70[*1]	Radiant aluminium panel
Aquaztrip Flex	💧	2,5–10	113-336[*1]	70[*1]	Radiant aluminium panel
Aquaztrip Comfort	💧	4–30	154-237[*1]	70[*1]	Radiant aluminium panel
Outdoors					
Infrared CIR	⚡	2–2,5	500-2000	750	Infrared heating rod
Infrared IHC	⚡	1,8–3	1150-1750	1200[*2]	Carbon lamp
Infrared IH	⚡	1,8–3,5	1000-2000	2200[*2]	Halogen lamp
Infragold IHG	⚡	1,8–2,5	1000	1800[*2]	Halogen lamp
Infraduo IHD	⚡	1,8–3,5	1650-2000	1800[*2]	Halogen lamp
Infrasmart IHS	⚡	1,8–3,5	1500-2000	1800[*2]	Halogen lamp
Infrapalm IHPA	⚡	2,5–2,7	1150-1750	1800[*2]	Halogen lamp
Infrared ELIR	⚡	2–3	1200	2200[*2]	Halogen lamp

Our products are divided into three main application areas: "Offices, shops and public premises", "Industry and large premises" and "Outdoors" but most products can be used in several application areas.
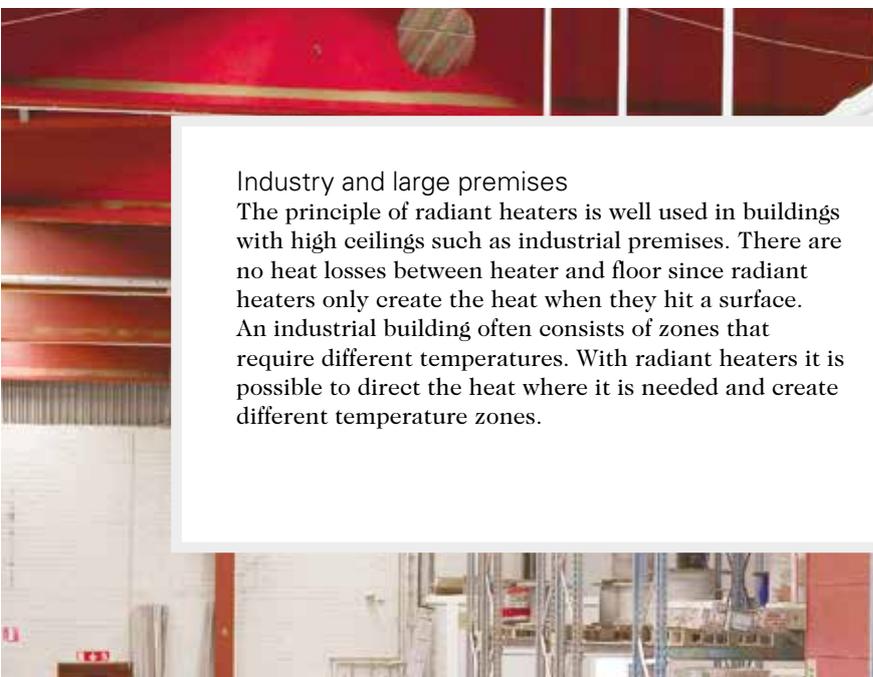
*1) Output per meter. Depending on water temperature.
*2) Filament temperature

Offices, shops and public premises

Radiant heaters offer many advantages for applications where silent, discreet and efficient heating is required. They give a safe, hygienic and pleasant heat. Mounting on the ceiling or recessed in a false ceiling leaves the walls free and gives a discreet heating. Ceiling mounting also protects the heaters from damage, which ensures longer life. With zone and spot heating as well as protection against cold draughts it is possible to create a comfortable indoor climate with the best economy.

Industry and large premises

The principle of radiant heaters is well used in buildings with high ceilings such as industrial premises. There are no heat losses between heater and floor since radiant heaters only create the heat when they hit a surface. An industrial building often consists of zones that require different temperatures. With radiant heaters it is possible to direct the heat where it is needed and create different temperature zones.

Outdoors

The summer season can be prolonged with the use of radiant heaters for outdoor use. There are different solutions depending on the environment. For open-air restaurants without protective walls a heater with a high surface temperature is required. The better the area is protected against the wind, the less output you need, which means you are not as dependent on heaters with a high surface temperature.
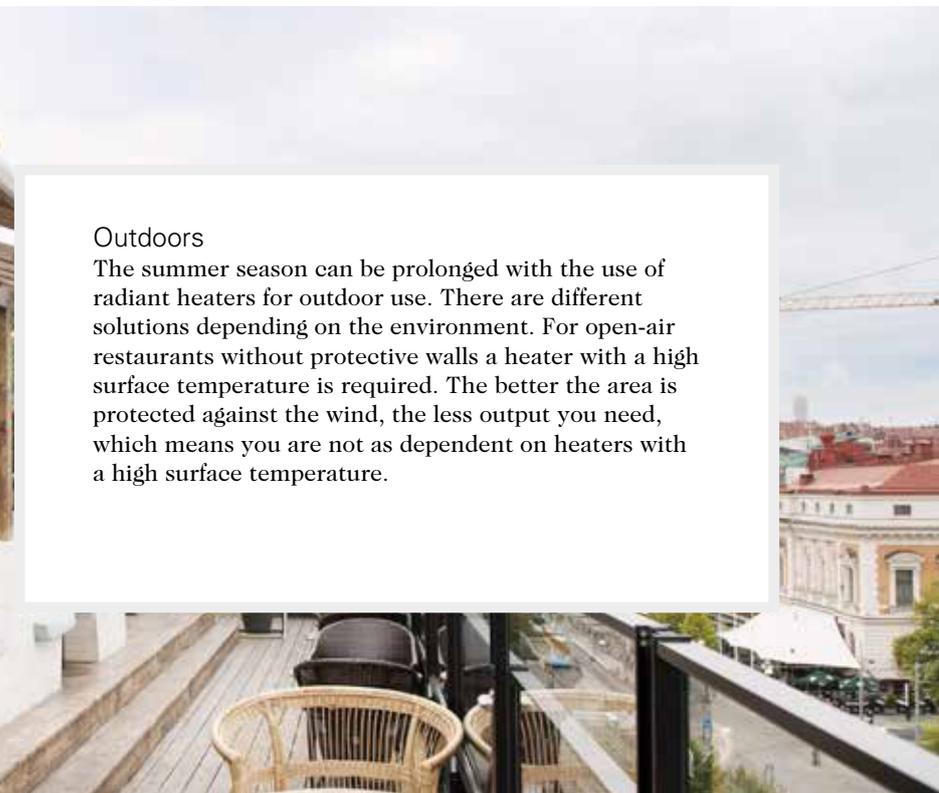
Installation examples for radiant heaters

Frico radiant heaters are available for different kinds of heating and for different application areas. To facilitate your choice of product, you will find some typical cases on the following pages. More detailed information on important factors to consider when choosing a radiant heater is found on the previous pages.

Basic criterias:
1. Type of premises – store, warehouse etc.
2. Type of heating - total heating, zone heating, cold draught protection
3. Height: installation height
4. Mounting: wall or ceiling
5. Connection: with electrical heat or water heat

Total heating, cafeteria

1. Type of premises: cafeteria
2. Type of heating: total heating
3. Height: 2,80 metres
4. Mounting: ceiling
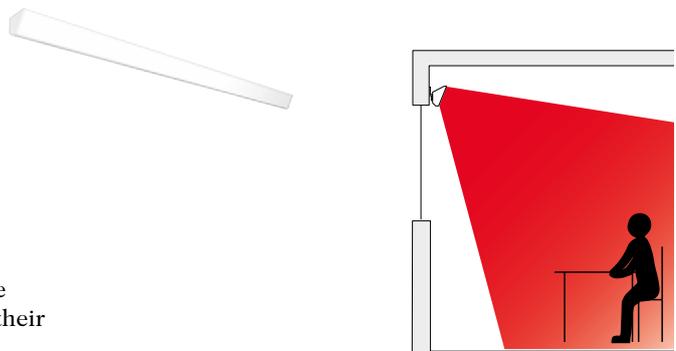5. Connection: electrical

Recommendation: Thermocassette can be recessed into a false ceiling. When using Thermocassette for total heating, the units should be spread out through the ceiling for example as shown.
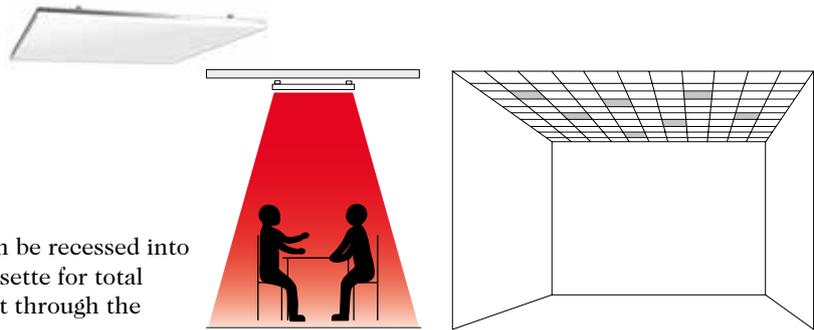
Cold draught protection, office

1. Type of premises: office
2. Type of heating: cold draught protection
3. Height: 3 metres
4. Mounting: wall
5. Connection: electrical

Recommendation: Thermoplus is designed for cold draught protection for normally sized windows. The heaters are mounted above the windows, covering their whole width for maximum protection.

Zone heating, restaurant terrace

1. Type of premises: sheltered restaurant terrace
2. Type of heating: zone heating
3. Height: 2,5 metres
4. Mounting: ceiling (above the tables)
5. Connection: with electrical heat

Recommendation: Several CIR mounted in line above the tables ensure the comfort for all customers in deep terraces.
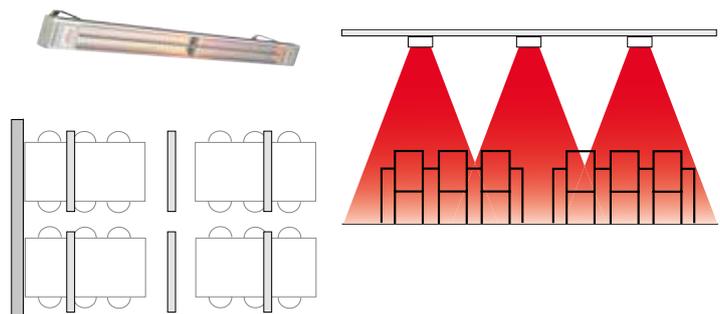
Zone heating, open air café

1. Type of premises: open air café
2. Type of heating: zone heating
3. Height: 3 metres
4. Mounting: wall and ceiling structure
5. Connection: with electrical heat

Recommendation: IH can be mounted on the wall of the restaurant or on any ceiling structure. Best comfort is given if the heaters heat from two directions.

Total heating, workshop

1. Type of premises: workshop
2. Type of heating: total heating
3. Height: 5 metres
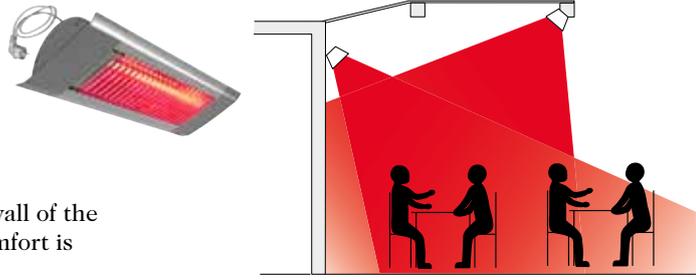4. Mounting: ceiling
5. Connection: with electrical heat

Recommendation: A number of EZ300 evenly positioned over the area to be heated creates comfortable heat.
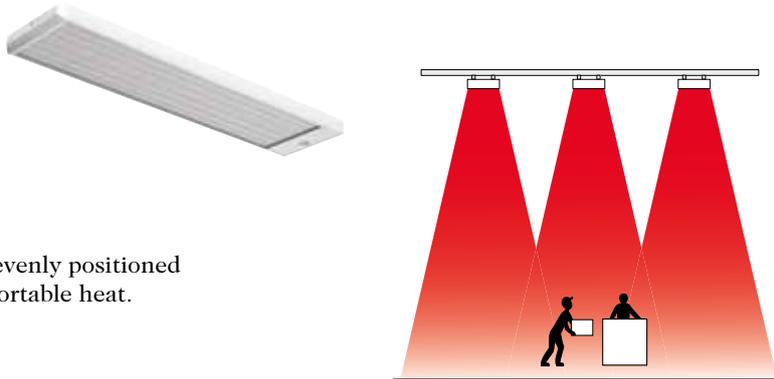
Zone heating, factory

1. Type of premises: work station in factory
2. Type of heating: zone heating
3. Height: 6 metres
4. Mounting: ceiling
5. Connection: with electrical heat

Recommendation: The reflectors of IR reduces the heat dispersion making IR emitting heat on a defined area. This makes IR well suited for zone heating in industrial applications.

Total heating, warehouse

1. Type of premises: warehouse
2. Type of heating: total heating
3. Height: 8 metres
4. Mounting: ceiling
5. Connection: with water heat

Recommendation: Lines of Aquaztrip panels in the ceiling ensure a comfortable indoor climate in buildings with water supplied heating systems.
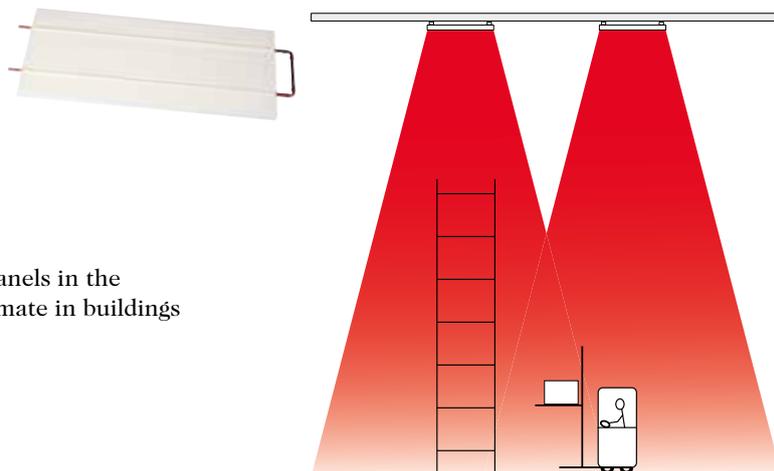
2 - 3 m
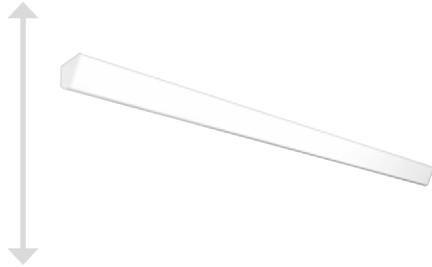
Thermoplus EC
Thermoplus is mounted above windows and gives an effecient protection against cold draught. The slim shape also makes it suitable for heating areas with limited space, like for example bathrooms. Thermoplus can furthermore be a cost-effective and flexible alternative to floor heating.

<3 m

Thermocassette HP
Thermocassette is intended for discreet heating in offices, bathrooms, schools etc. Designed for either surface or recessed mounting it is well suited for total heating as well as for spot heating of for example a reception desk. Mounted in a false ceiling it is well protected against damage.

2,5 - 4 m

Elztrip EZ100
EZ100 is intended for total and supplementary heating as well as protection against cold draughts from windows in environments such as offices, shops, restaurants etc.

Offices, shops and public premises

Radiant heaters offer many advantages for applications where silent, discreet and efficient heating is required. They give a safe, hygienic and pleasant heat.

Mounting on the ceiling or recessed in a false ceiling leaves the walls free and gives a discreet heating. Ceiling mounting also protects the heaters from damage, which ensures longer life.

With zone and spot heating as well as protection against cold draughts it is possible to create a comfortable indoor climate with the best economy.

Thermoplus EC

Slim radiant heater for protection against cold draughts

Thermoplus is mounted above windows and gives an effecient protection against cold draught. The slim shape also makes it suitable for heating areas with limited space, like for example bathrooms. Thermoplus can furthermore be a cost-effective and flexible alternative to floor heating.
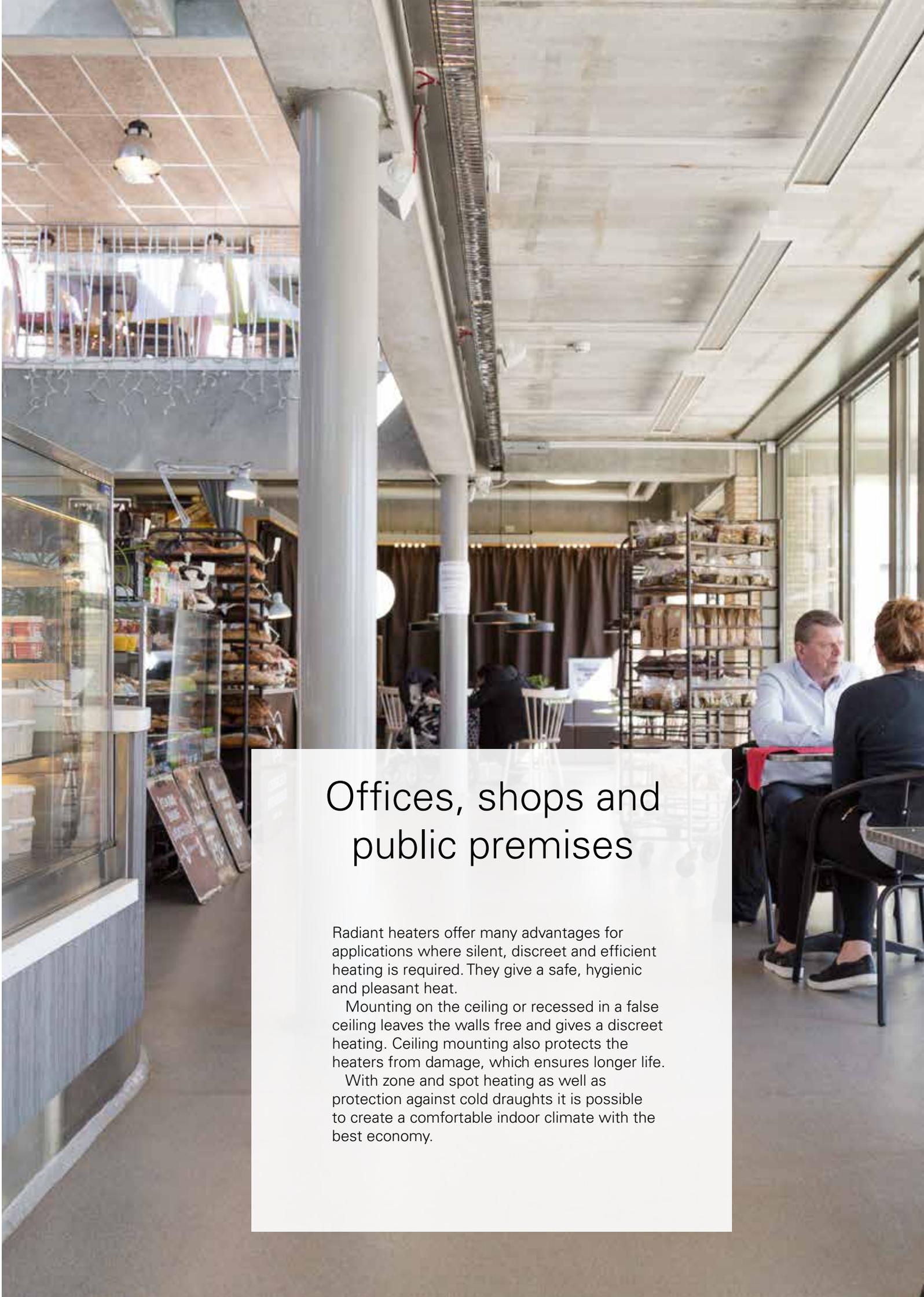
Thermoplus is covered with white enamel which makes it discreet and scratch-resistant. The slim shape makes it practically invisible when mounted in the ceiling angle.

- Thermoplus is available in following versions:
  - **Type EC**, for dry rooms. IP20.
  - **Type ECV**, for wet rooms. IP44.
  - **Type ECVTN**, for wet rooms. With a built-in thermostat (+5 – +37 °C). IP44.
- To comply with Ecodesign Regulation (EU) 2015/1188 units EC and ECV must be installed with thermostat TAP16R (accessory). TAP16R has adaptive start, week program and open window detection. ECVTN is equiped with a built-in Ecodesign approved thermostat.
- Wall brackets included. Ceiling mounting kit is available as an accessory.
- Front panel of white scratch-resistant enamelled aluminium. Colour: RAL 9010. Rear panel of hot zinc-plated steel panels.

Thermoplus EC for dry rooms (IP20)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. surface temp. [°C]	LxHxD [mm]	Weight [kg]
EC45021	450	230V~	2,0	180	1076x100x90	2,6
EC60021	600	230V~	2,6	180	1505x100x90	3,7
EC75021	750	230V~	3,3	180	1810x100x90	4,4
EC90021	900	230V~	3,9	180	2140x100x90	4,8
EC90031	900	400V2~	2,3	180	2140x100x90	4,8

Thermoplus ECV for wet rooms (IP44)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. surface temp. [°C]	LxHxD [mm]	Weight [kg]
ECV30021	300	230V~	1,3	180	870x100x90	2,3
ECV55021	550	230V~	2,4	180	1505x100x90	4,0
ECV55031	550	400V2~	1,4	180	1505x100x90	4,0
ECV70021	700	230V~	3,0	180	1810x100x90	4,7
ECV70031	700	400V2~	1,8	180	1810x100x90	4,7

Thermoplus ECVTN for wet rooms, with built-in thermostat (IP44)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. surface temp. [°C]	LxHxD [mm]	Weight [kg]
ECVTN30021	300	230V~	1,3	180	870x100x135	2,3
ECVTN55021	550	230V~	2,4	180	1505x100x135	4,6
ECVTN70021	700	230V~	3,0	180	1810x100x135	5,0

Design and specifications are subject to change without notice.

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Installation height

2 - 3 m

Minimum distances
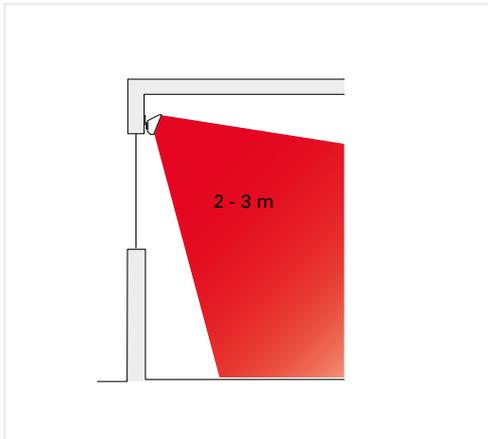
Flammable material

		Min.distance [mm]
Ceiling	A	60
Wall, long side of the unit	B	25
Flammable material, front of the unit	C	90
Flammable material, bottom of the unit	D	25
Floor	E	1800

Dimensions

A

B

	A [mm]	B [mm]
EC450	1076	600
EC600	1505	900
EC750	1810	1200
EC900	2140	1800
ECV/ECVTN300	870	400
ECV/ECVTN550	1505	900
ECV/ECVTN700	1810	1200

Mounting on the wall

EC, ECV

ECVTN

Mounting on the ceiling

Fixture for ceiling mounting

EC, ECV

ECVTN

CE

Thermoplus

Mounting and connection

Thermoplus is installed horizontally e.g. at the ceiling angle above the window. Wall brackets included. Ceiling mounting kit is available as an accessory.

Thermoplus is intended for permanent installation. Several Thermoplus can be connected to one thermostat.

Control options

Thermoplus EC and ECV must be installed with thermostat TAP16R which offers adaptive start, week program and open window detection. Please note that a relaybox RB3 is required for 400V~ products.

Protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor.

Thermoplus ECVTN has a built-in thermostat (+5 – +37 °C).

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls and accessories
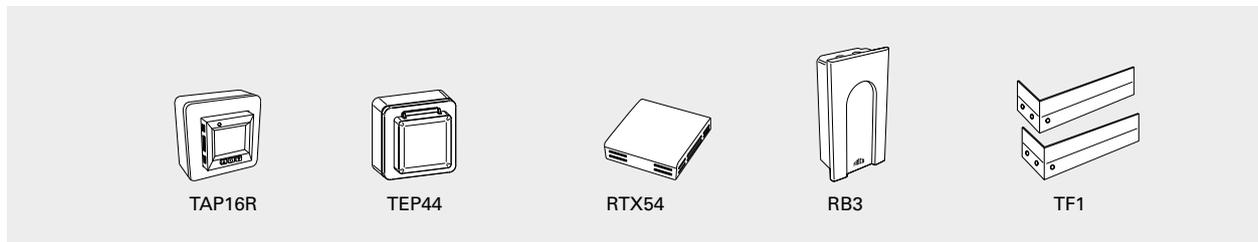
| TAP16R | TEP44 | RTX54 | RB3 | TF1 |

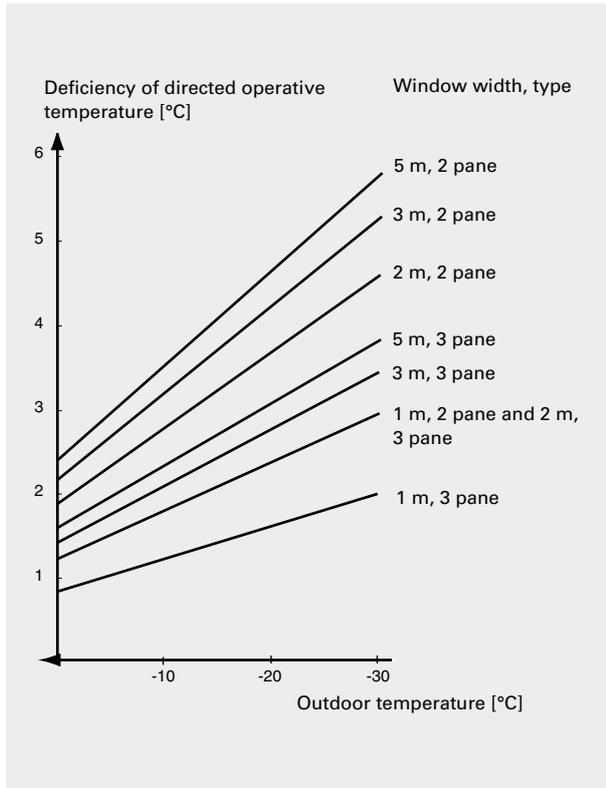| Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44	155x87x43
TF1	Fixture for ceiling mounting (2 pcs)	

The space close to the window can be used when the cold draught is eliminated. Mounted close together several Thermoplus form a continous plinth.

Thermoplus creates a pleasant heat in the room and on the floor and can be a cost effective alternative to floor heating.

Effect on the temperature near windows

Deficiency of directed operative temperature [°C]

Window width, type

5 m, 2 pane

3 m, 2 pane

2 m, 2 pane

5 m, 3 pane

3 m, 3 pane

1 m, 2 pane and 2 m, 3 pane

1 m, 3 pane

y-axis: 6, 5, 4, 3, 2, 1

x-axis: -10, -20, -30

Outdoor temperature [°C]

Temperature differentials
The diagram to the left refers to temperature loss through a window that is 1.7 metre high and is measured 1.0 metre into the room from the centre of the window.

Heat contribution
The contribution to operative temperature is measured at a ceiling height of 2.4 metres, one meter into the room from the centre of the window.

Contribution of directed operative temperature [°C]

y-axis: 4, 3, 2, 1, 0

x-axis: 1, 2, 3

Heater length [m]
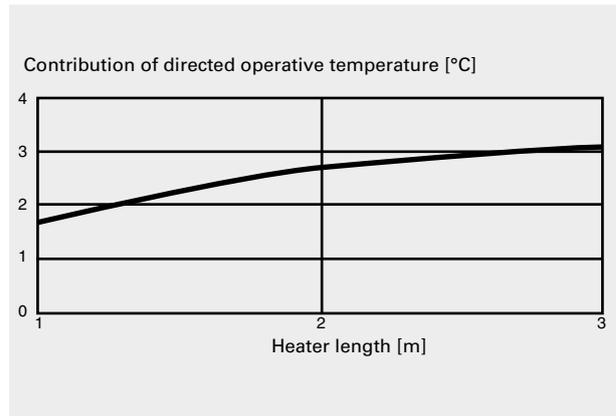
Thermoplus takes up minimum space mounted in the ceiling angle.
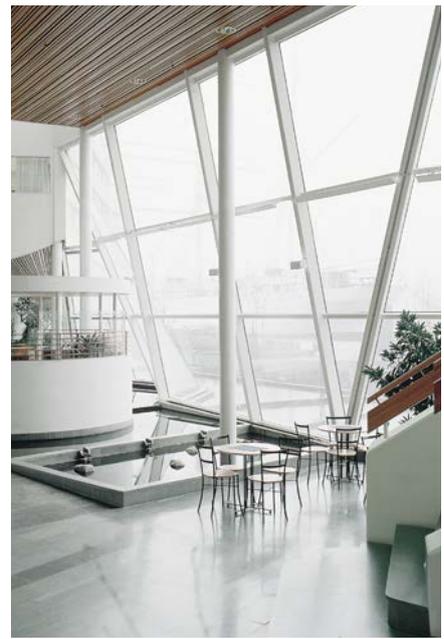
Thermoplus is used for cold draught protection. The radiant heat moulding is very discreet as it is positioned high up along a beam.

Thermocassette HP

Discreet radiant heat cassette for recessed or surface mounting

Thermocassette is intended for discreet heating in offices, bathrooms, schools etc. Designed for either surface or recessed mounting it is well suited for total heating as well as for spot heating of for example a reception desk. Mounted in a false ceiling it is well protected against damage.

Recessed mounting make the heater an integral part of the ceiling.

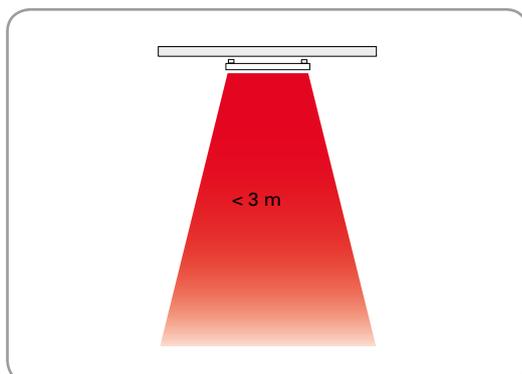- The low surface temperature (max. 100 °C) makes Thermocassette well suited for low ceiling heights. There is no risk of burns to the person(s) in this vicinity.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed with thermostat TAP16R (accessory). TAP16R has adaptive start, week program and open window detection.
- High protection class, IP55.
- Complies with requirements of flammable areas according to SEMKO 111FF.
- Corrosion proof casing of hot zinc-plated and powder lacquered steel panels. Colour: white, RAL 9016, NCS S 0500-N. Other RAL colours are available on request.

Thermocassette HP (IP55)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. surface temperature [°C]	Dimensions LxWxH [mm]	Weight [kg]
HP3N	300	230V~	1,3	100	593x593x80*	5,8
HP6N	600	230V~	2,6	100	593x1193x80*	10,7

*) Height with brackets.

Installation height

< 3 m

Minimum distances

Flammable material

Design and specifications are subject to change without notice.

HP3N

679

1,8 m

50
30
80

593
480

480
593

HP6N

816

1,8 m

50
30
80

593
480

660
1193

CE
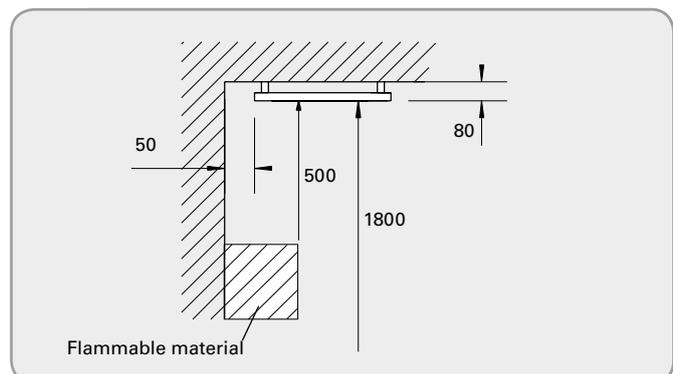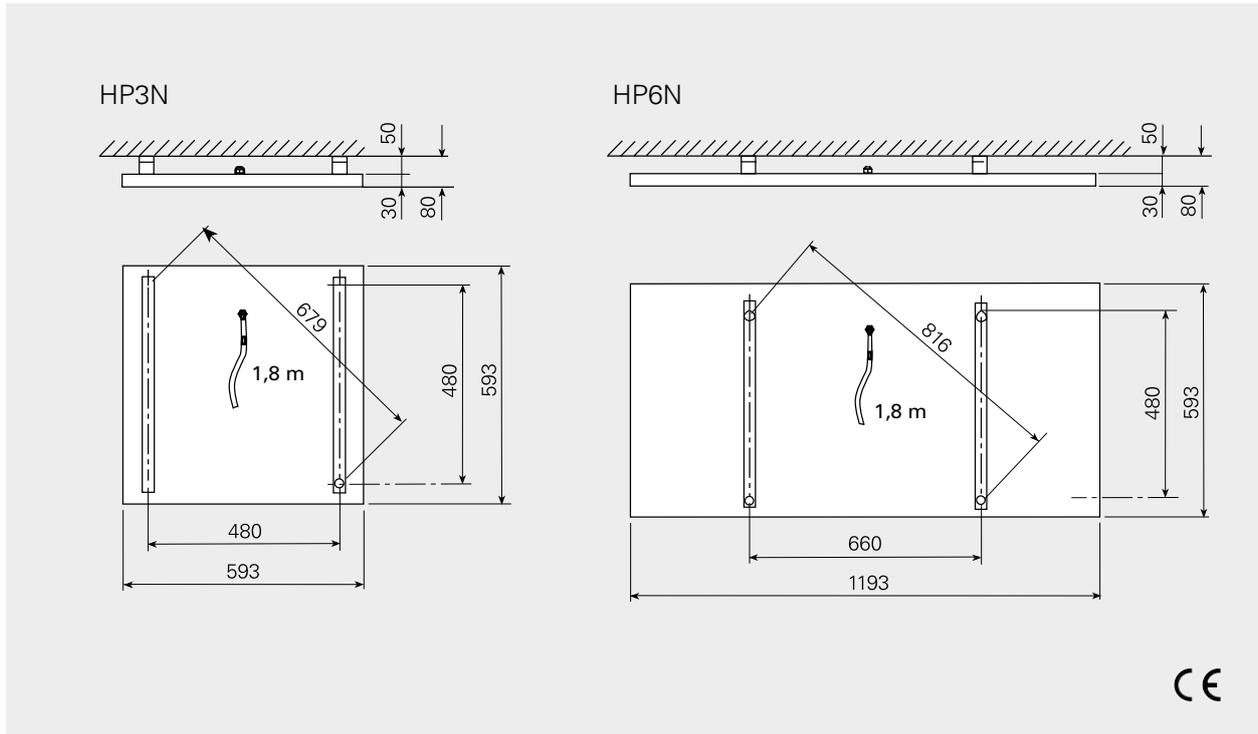
Mounting on the ceiling protects Thermocassette against damage.

An attractive and almost invisible heating is created when Thermocassette is mounted in a false ceiling. The heating cassettes can easily be moved if the furnishing is rearranged.

Thermocassette HP

Positioning, mounting and connection

Positioning
To estimate approximately how many radiant heaters are needed to cover an area the formula is:

$$\text{Min. number of heaters} = \frac{\text{Area of the premises [m}^2\text{]}}{\text{Installation heigth [m]} \times \text{Installation heigth [m]}}$$

This formula is a basic estimation of the minimum number of radiant heaters needed to maintain the comfort. To calculate the right output for each heater, the total heating requirement must be calculated, see the Technical handbook.
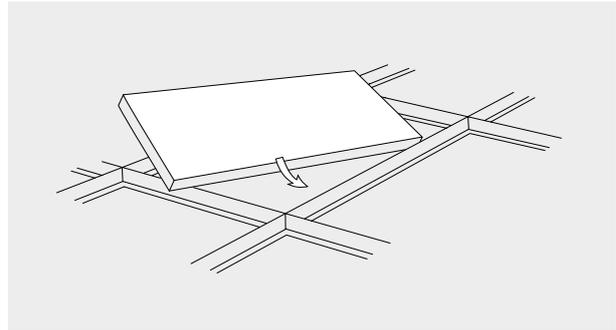
Mounting in false ceilings.

Mounting
HP can be recessed in false ceilings, mounted externally with brackets on the ceiling or suspended by wire. Mounting brackets are included. Wire mounting kit is available as an accessory.

Connection
HP is equipped with a 1,8 meter cable without plug.

Accessories

74701, wire mounting kit
Complete mounting kit for mounting on wire, gives a drop of approx. 0.5 metres.

Type	Description
74701	Wire mounting kit

74701

Comfortable heat where you need it.

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection. Protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor.

Control by thermostat
• TAP16R, electronic thermostat

Control by thermostat and black bulb sensor
• TAP16R, electronic thermostat
• SKG30, black bulb sensor

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls

| TAP16R | TEP44 | RTX54 | SKG30 |
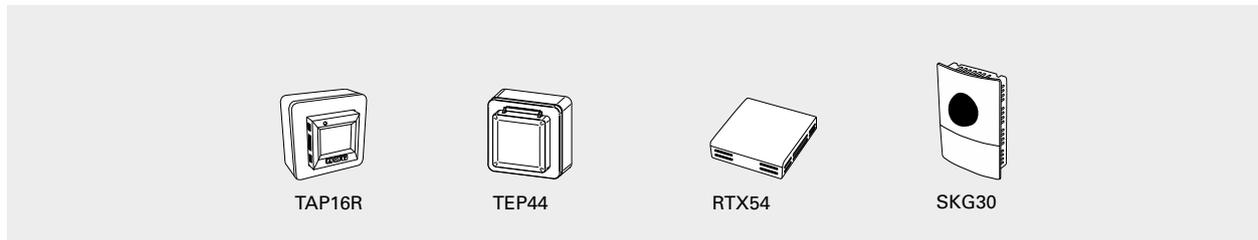
Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60

| KRT1900 | KRTV19 |

Elztrip EZ100

Single panel radiant heater for offices, shops etc.

EZ100 is intended for total and supplementary heating as well as protection against cold draughts from windows in environments such as offices, shops, restaurants etc.

EZ100 is a single panel radiant heater with clean and simple design that blends well with electrical fittings.

- Integrated elements and a surface structure for improved efficiency.
- The heaters are approved for serial connection.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed with thermostat TAP16R (accessory). TAP16R has adaptive start, week program and open window detection.
- Fixtures for easy mounting on the ceiling are included.
- Bracket for wall mounting is available as an accessory.
- Corrosion proof casing of hot zinc-plated and powder lacquered steel panels. Colour: white, RAL 9016, NCS S 0500-N. Heating panel of naturally anodised aluminium.

Elztrip EZ100 (IP44)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. surface temperature [°C]	Dimensions LxHxW [mm]	Weight [kg]
EZ106N	600	230V~	2,6	320	870x50x150	3,2
EZ111N	1100	230V~	4,8	320	1470x50x150	5,4
EZ115N	1500	230V~	6,5	320	1950x50x150	7,0

Installation height

2,5–4 m

Minimum distances

Ceiling

50

50

1800

Wall

50

500

Flammable material

Design and specifications are subject to change without notice.

Dimensions

	L [mm]	A [mm]
EZ106N	870	655
EZ111N	1470	1252
EZ115N	1950	1731

Positioning, mounting and connection

Positioning

To estimate approximately how many radiant heaters are needed to cover an area the formula is:

$$\text{Min. number of heaters} = \frac{\text{Area of the premises [m}^2\text{]}}{\text{Installation heigth [m]} \times \text{Installation heigth [m]}}$$

This formula is a basic estimation of the minimum number of radiant heaters needed to maintain the comfort. To calculate the right output for each heater, the total heating requirement must be calculated, see the Technical handbook.

When planning an Elztrip installation, the distance between the heaters should not be greater than the height between heater and floor, that means (a) should be less than (H). See Fig. In rooms not often used, the comfort demands are usually lower and the distance between the heaters can be increased. In rooms frequently used, the distance between a sedentary person and heater should be at least between 1.5 to 2 metres (Δh). When these two guide lines are followed, the difference in operative temperature will not exceed the comfort level Δt_{op}= 5 °C. This means that the difference between the real temperature and the temperature that we sense, will not be more than 5 °C.

Mounting

Elztrip is installed horizontally on ceilings, in armature rails, on cables, suspended, etc. Fixtures for easy mounting on the ceiling are included. If the heater is suspended by wires, use the four mounting points on the heater. Bracket for wall mounting is available as an accessory.

Connection

Elztrip is intended for permanent installation. The heaters are approved for serial connection.
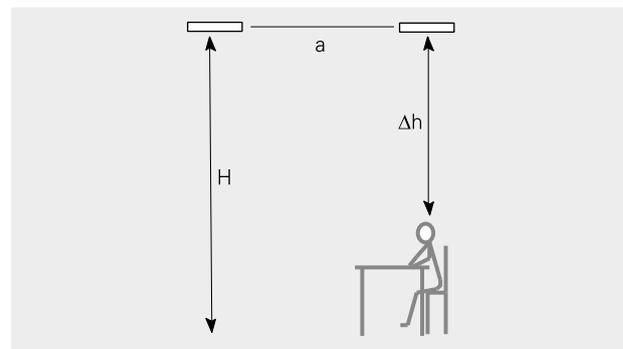
Recommended distances for Elztrip
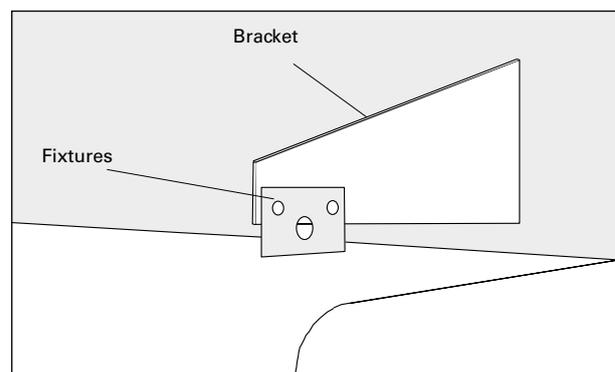
Brackets for wall mounting EZMVK (extra).

Elztrip EZ100

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection. Protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor.

Control by thermostat
- TAP16R, electronic thermostat

Control by thermostat and black bulb sensor
- TAP16R, electronic thermostat
- SKG30, black bulb sensor

Control by thermostat and presence detector
- TAP16R, electronic thermostat
- PDK65, presence detector with power supply

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls and accessories

TAP16R	TEP44	RTX54	SKG30	PDK65	PDK65S	EZMVK

Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65	102x70x50 88x88x39
PDK65S	Additional presence detector to PDK65, IP42	102x70x50
EZMVK	Mounting bracket	

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

	KRT1900	KRTV19

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60

Corridors can be difficult to heat, but ceiling mounted EZ100 give off heat just where it is needed.

Using the radiation principle, air is not heated directly. This results in a soft, draught-free, comfortable indoor climate and an even temperature.

Buildings that are used on an irregular basis can be heated fast without a high energy consumption. EZ100 blends well with electrical fittings.

Spot heating with EZ100 is safe and hygienic.

3 - 10 m

Elztrip EZ200
EZ200 is intended for total and supplementary heating as well as protection against cold draughts from windows in environments such as, department stores, assembly halls, industrial premises etc.

4 - 15 m

Elztrip EZ300
EZ300 is intended for total and supplementary heating in industrial environments such as warehouses, workshops etc.

4 - 20 m

Industrial infrared heater IR
IR is suitabe for total or supplementary heating of premises with large volume and high ceilings. It can also be used outdoors for example on sport arena stands or to keep loading bays dry and frostless.

3 - 10 m

Halogen infrared heater IRCF
IRCF is especially designed for spot heating of premises with large air volumes, such as churches, aircraft hangars and marquees. With its high efficiency and compact size it is perfect for many difficult applications.

2,5 - 30 m

Aquaztrip
Aquaztrip is our product range of water heated radiant panels with a wide area of application in both commercial and industrial buildings.
The range includes Aquaztrip Plan, Aquaztrip Flex and Aquaztrip Comfort.

Industry and large premises

The principle of radiant heaters is well used in buildings with high ceilings such as industrial premises. There are no heat losses between heater and floor since radiant heaters only create the heat when they hit a surface. An industrial building often consists of zones that require different temperatures. With radiant heaters it is possible to direct the heat where it is needed and create different temperature zones.

Elztrip EZ200

Double panel radiant heater for department stores, industrial premises etc.

EZ200 is intended for total and supplementary heating as well as protection against cold draughts from windows in environments such as, department stores, assembly halls, industrial premises etc.
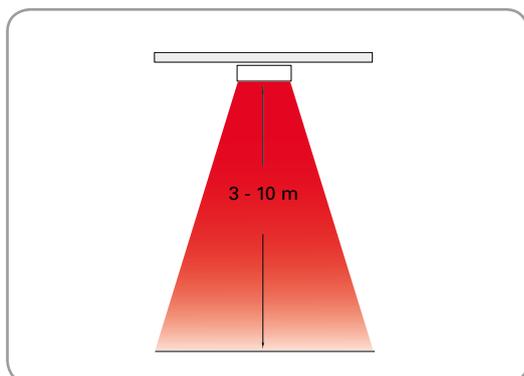
EZ200 is a double panel radiant heater with clean and simple design that blends well with electrical fittings.

- Integrated elements and a surface structure for improved efficiency.
- The heaters are approved for serial connection.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed with thermostat TAP16R (accessory). TAP16R has adaptive start, week program and open window detection.
- Standard mountings for installation included.
- Corrosion proof casing of hot zinc-plated and powder lacquered steel panels. Colour: RAL 9016, NCS S 0500-N. Heating panel of naturally anodised aluminium.

Elztrip EZ200 (IP44)

Type	Heat output	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
EZ208	800	230V~	3,5	320	683x64x282	4,9
EZ212	1200	230V~	5,2	320	923x64x282	6,8
EZ217	1700	230V~	7,4	320	1221x64x282	8,8
EZ222	2200	230V~	9,6	320	1520x64x282	10,7
EZ20831	800	400V2~	2,0	320	683x64x282	4,9
EZ21231	1200	400V2~	3,0	320	923x64x282	6,8
EZ21731	1700	400V2~	4,3	320	1221x64x282	8,8
EZ22231	2200	400V2~	5,5	320	1520x64x282	10,7

Installation height

Minimum distances

Design and specifications are subject to change without notice.

Dimensions

B A C

80
64
282

L

ø20,5 (2x)

160

63

	L [mm]	A [mm]	B [mm]	C [mm]
EZ208	683	400	90	193
EZ212	923	600	110	213
EZ217	1221	900	109	212
EZ222	1520	1200	108	212

CE

Temperature contribution

$$\Delta t_{op} = t_{room} + \frac{\Delta t_{rad.}}{2}$$

$[\Delta t_{rad.}]$

EZ222

Installation height
- - - - 1 m
——— 2 m
········· 3 m

30 °C
25 °C
20 °C
15 °C
10 °C
5 °C

- 1,5   - 1   - 0,5   0   0,5   1   1,5   2   [m]
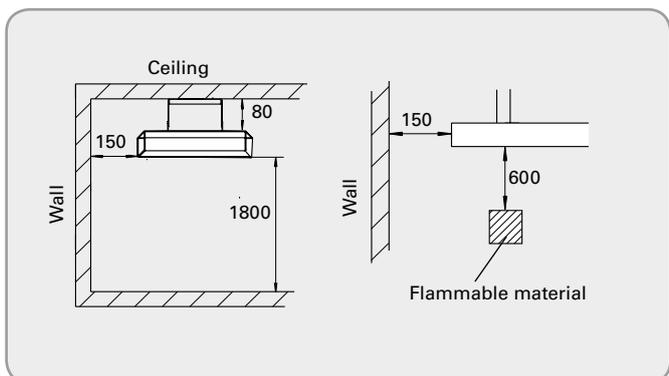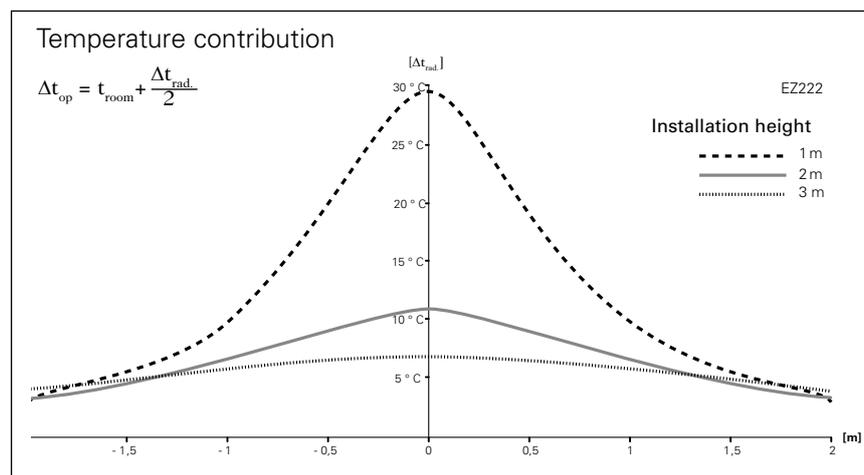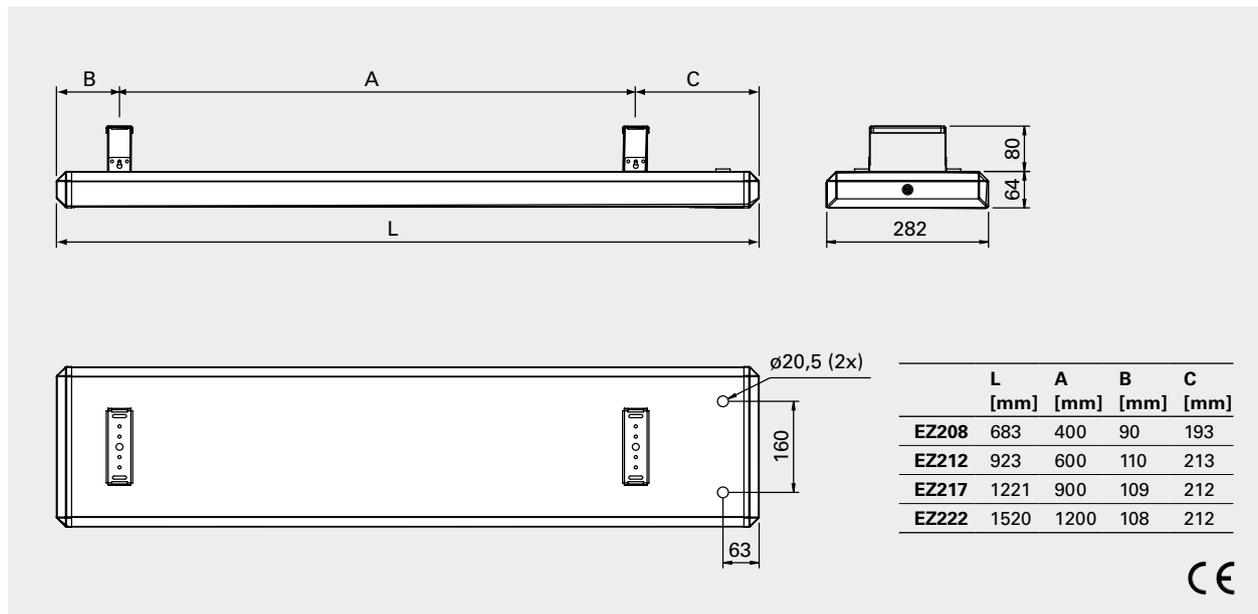
Elztrip is an elegant and effective solution to cold draught problems Hilton in Malmö has adopted this solution in their large glass lobby.

EZ200 is a perfect solution for heating working stations.

Positioning, mounting and connection

Positioning

To estimate approximately how many radiant heaters are needed to cover an area the formula is:

$$\frac{\text{Min. number}}{\text{of heaters}} = \frac{\text{Area of the premises [m}^2\text{]}}{\text{Installation heigth [m] × Installation heigth [m]}}$$

This formula is a basic estimation of the minimum number of radiant heaters needed to maintain the comfort. To calculate the right output for each heater, the total heating requirement must be calculated, see the Technical handbook.
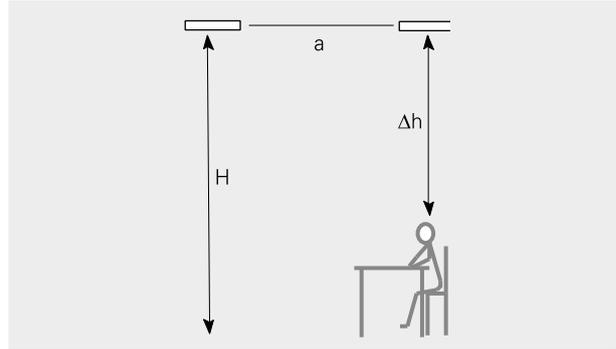
When planning an Elztrip installation, the distance between the heaters should not be greater than the height between heater and floor, that means (a) should be less than (H). See Fig. In rooms not often used, the comfort demands are usually lower and the distance between the heaters can be increased. In rooms frequently used, the distance between a sedentary person and heater should be at least between 1.5 to 2 metres (Δh). When these two guide lines are followed, the difference in operative temperature will not exceed the comfort level Δt_{op} = 5 °C. This means that the difference between the real temperature and the temperature that we sense, will not be more than 5 °C.

Mounting

Elztrip is installed horizontally on ceilings, in armature rails, on cables, suspended, etc. Standard mountings for installation included. If the heater is suspended by wires, use the four mounting points on the heater. Standard fittings for mounting are included. When mounting on wire, suitable clips that prevent the panel from sliding should be acquired.

Connection

Elztrip is intended for permanent installation. The heaters are approved for serial connection.

Recommended distances for Elztrip
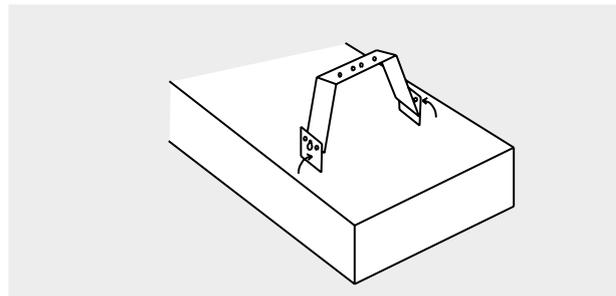
Standard fitting

Heating with EZ200 is hygienic since it does not cause any air movements.

EZ200 gives instant heat and no preheating is necessary which makes it ideal for buildings that are used on an irregular basis.

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection. Protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor. Please note that a relaybox RB3 is required for 400V~ products.

Control by thermostat
- TAP16R, electronic thermostat
- RB3, relaybox 400V3N~ (EZ200 400V~)

Control by thermostat and black bulb sensor
- TAP16R, electronic thermostat
- SKG30, black bulb sensor
- RB3, relaybox 400V3N~ (EZ200 400V~)

Control by thermostat and presence detector
- TAP16R, electronic thermostat
- PDK65, presence detector with power supply
- RB3, relaybox 400V3N~ (EZ200 400V~)

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls and accessories

TAP16R   TEP44   RTX54   SKG30   PDK65   PDK65S   RB3

Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65	102x70x50 88x88x39
PDK65S	Additional presence detector to PDK65, IP42	102x70x50
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44	155x87x43

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60

KRT1900   KRTV19

Elztrip EZ300

Triple panel radiant heater for warehouses, workshops etc.

EZ300 is intended for total and supplementary heating in industrial environments such as warehouses, workshops etc.

EZ300 is a triple panel radiant heater with discreet and robust design that blends well with electrical fittings.

- Integrated elements and a surface structure for improved efficiency.
- The heaters are approved for serial connection.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed either with thermostat TAP16R or with output control RB123 and presence detector PDK65 (accessories).
- Standard mountings for installation included.
- Casing of grey alu-zinc coated steel panels, very resistant against corrosion. Heating panel of naturally anodised aluminium.

Elztrip EZ300 (IP44)

Type	Heat output	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
EZ336	3600	230V3~/400V3N~	9,0/5,2	320	1670x63x420	19,8
EZ345	4500	230V3~/400V3N~	11,3/6,5	320	2030x63x420	24,2

Installation height
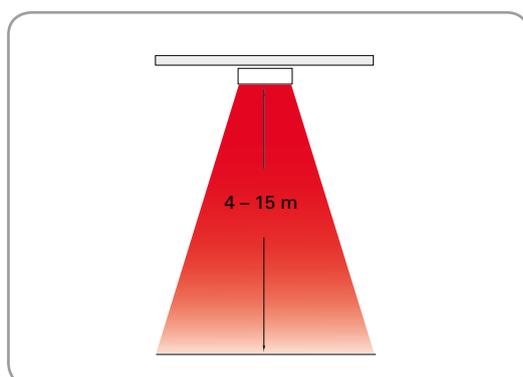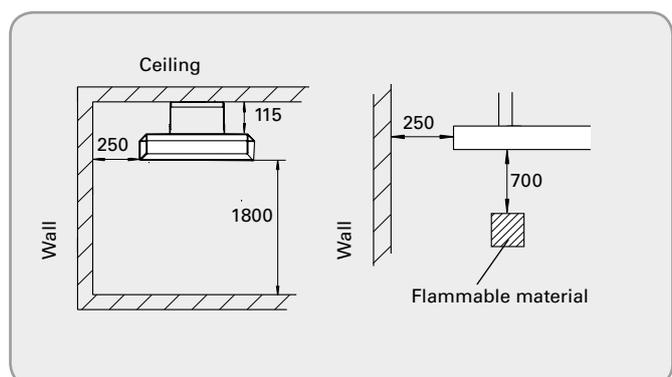
4 – 15 m

Minimum distances

Design and specifications are subject to change without notice.

Dimensions

	L [mm]	A [mm]	B [mm]
EZ336	1670	1200	235
EZ345	2030	1500	265

ø32,5 (2x)
200
40
420
120
63

CE

Temperature contribution

$$\Delta t_{op} = t_{room} + \frac{\Delta t_{rad.}}{2}$$

$[\Delta t_{rad.}]$

EZ300

Installation height
- - - - 1 m
——— 2 m
········· 3 m

50 °C
40 °C
30 °C
20 °C
10 °C

-2   -1,5   -1   -0,5   0   0,5   1   1,5   2   [m]
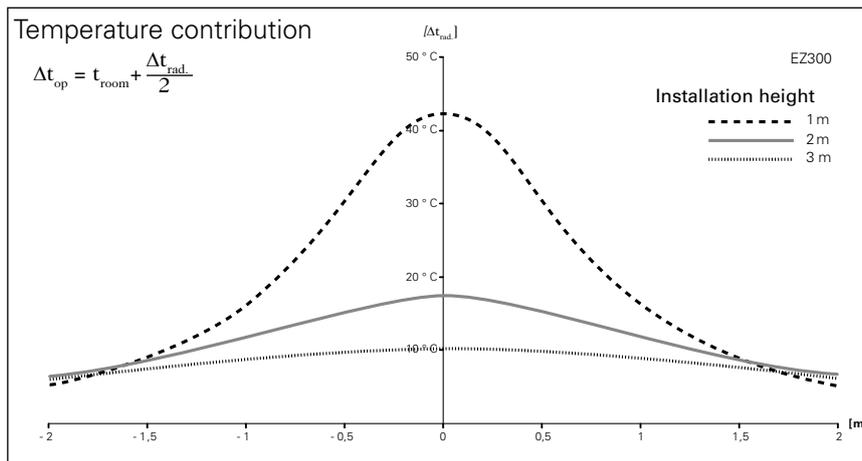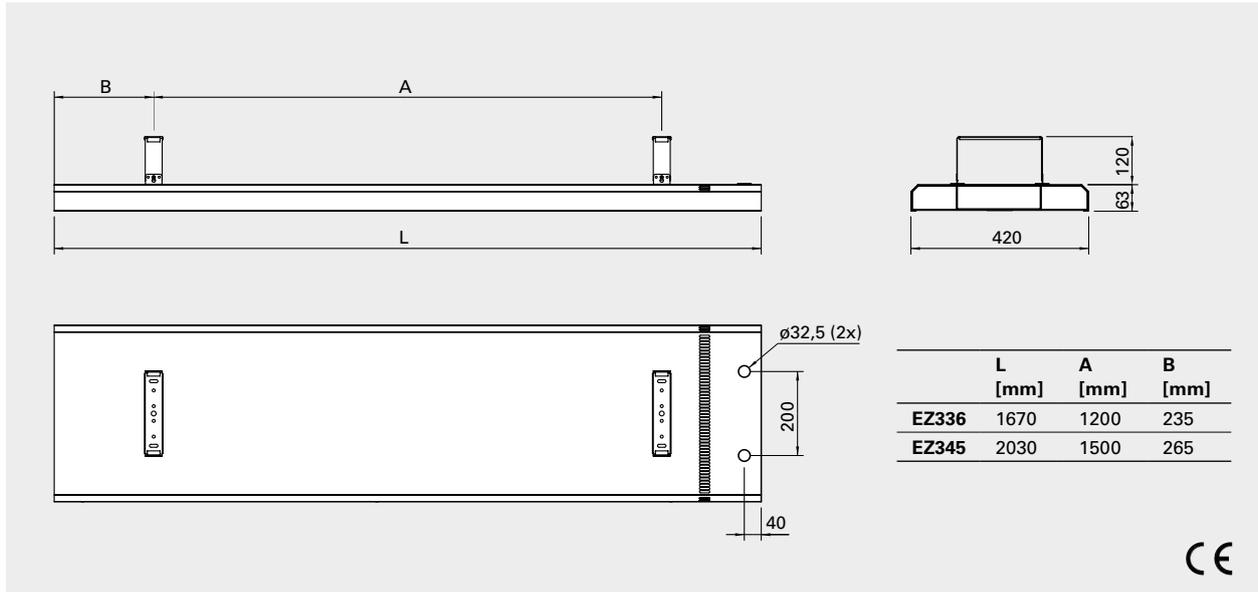
EZ300 gives instant heat and no preheating is necessary which makes it ideal for buildings that are used on an irregular basis.

Radiant heaters are especially profitable in buildings with high ceilings as no heat losses occur between the heater and the floor.

Elztrip EZ300

Positioning, mounting and connection

Positioning

To estimate approximately how many radiant heaters are needed to cover an area the formula is:

$$\text{Min. number of heaters} = \frac{\text{Area of the premises [m}^2]}{\text{Installation heigth [m]} \times \text{Installation heigth [m]}}$$

This formula is a basic estimation of the minimum number of radiant heaters needed to maintain the comfort. To calculate the right output for each heater, the total heating requirement must be calculated, see the Technical handbook.

When planning an Elztrip installation, the distance between the heaters should not be greater than the height between heater and fl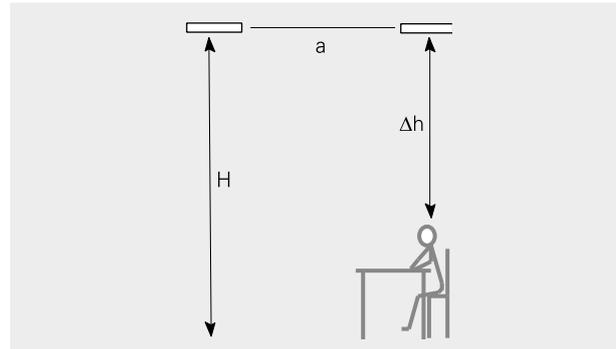oor, that means (a) should be less than (H). See Fig. In rooms not often used, the comfort demands are usually lower and the distance between the heaters can be increased. In rooms frequently used, the distance between a sedentary person and heater should be at least between 1.5 to 2 metres (Δh). When these two guide lines are followed, the difference in operative temperature will not exceed the comfort level $\Delta t_{op} = 5\ ^\circ\text{C}$. This means that the difference between the real temperature and the temperature that we sense, will not be more than 5 °C.

Recommended distances for Elztrip
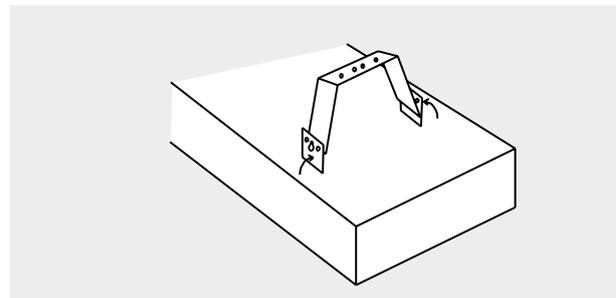
Mounting

Elztrip is installed horizontally on ceilings, in armature rails, on cables, suspended, etc. Standard mountings for installation included. If the heater is suspended by wires, use the four mounting points on the heater. Standard fittings for mounting are included. When mounting on wire, suitable clips that prevent the panel from sliding should be acquired.

Standard fitting

Connection

Elztrip is intended for permanent installation. The heaters are approved for serial connection.

With radiant heaters, the heat is transferred to surfaces such as people, floors and fixtures. This creates comfort even in rooms with large volume.

The heat is directed to the area where it is needed the most.

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection. When using TAP16R, protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor. Please note that a relaybox RB is also required.

Control by thermostat
• TAP16R, electronic thermostat
• RB3, relaybox 400V3N~/230V3~

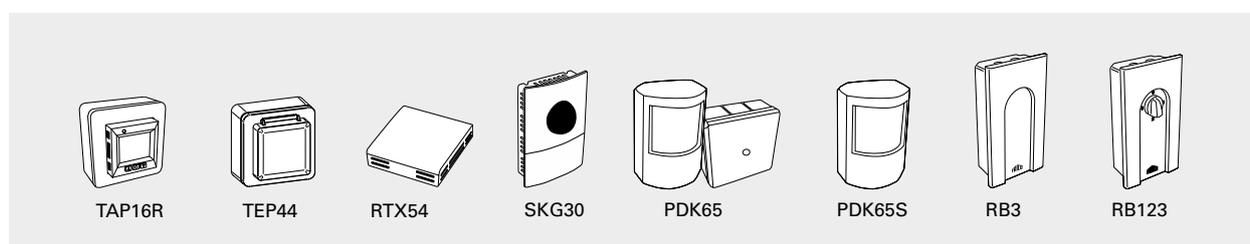### Control by thermostat and black bulb sensor
• TAP16R, electronic thermostat
• SKG30, black bulb sensor
• RB3, relaybox 400V3N~/230V3~

Control by 3 step output control and presence detector
• RB123, relaybox with 3 step output control
• PDK65, presence detector with power supply

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls and accessories

TAP16R	TEP44	RTX54	SKG30	PDK65	PDK65S	RB3	RB123

Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65	102x70x50 88x88x39
PDK65S	Additional presence detector to PDK65, IP42	102x70x50
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44	155x87x43
RB123	Relaybox with 3 step output control, 400V3N~, 16A, IP44	155x87x43

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60
S123	Manual switch for 1-2-3 steps, 20A, IP42	72x64x46

KRT1900	KRTV19	S123

Industrial infrared heater IR

For premises with large volumes and high ceilings

IR is suitabe for total or supplementary heating of premises with large volume and high ceilings. It can also be used outdoors for example on sport arena stands or to keep loading bays dry and frostless.

    IR has a robust industrial design.

- Reflectors of shiny anodised aluminium for optimal heat distribution.
- The mounting brackets allow the heater to be angled in five different positions.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed either with thermostat TAP16R or with output control RB123 and presence detector PDK65 (accessories).
- Connection plinth which allows for connection of a regulator or for serial connection of several heaters.
- Protection grille is available as an accessory.
- Casing of grey alu-zinc coated steel panels, very resistant against corrosion.

Industrial infrared heater IR (IP44)

Type	Output steps	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[kW]	[V]	[A]	[°C]	[mm]	[kg]
IR3000	1/2/3	400V3N~*	4,3	700	1125x83x358	9,0
IR4500	1.5/3/4.5	400V3N~*	6,5	700	1500x83x358	11,1
IR6000	2/4/6	400V3N~*	8,7	700	1875x83x358	13,2

*) Can also be connected 400V3~, but then without output steps. With neutral, one element tube at a time can be connected.

Installation height
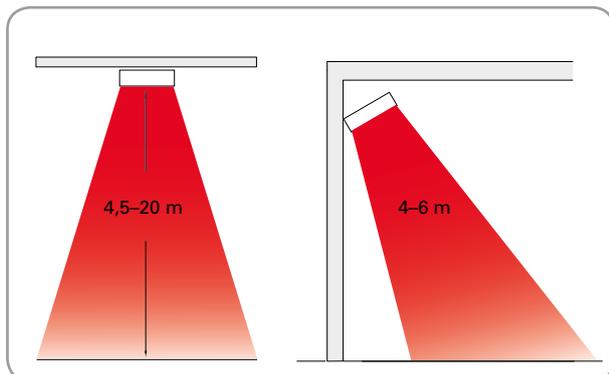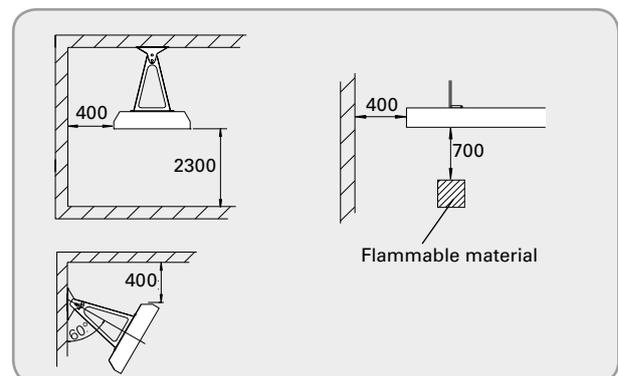
Minimum distances

Flammable material

Design and specifications are subject to change without notice.

Dimensions

	L1 [mm]	L2 [mm]
IR3000	600	1125
IR4500	900	1500
IR6000	1200	1875

CE

Temperature contribution

$$\Delta t_{op} = t_{room} + \frac{\Delta t_{rad.}}{2}$$

IR4500

Installation height
- - - - - 2 m
——— 3 m
············· 4 m
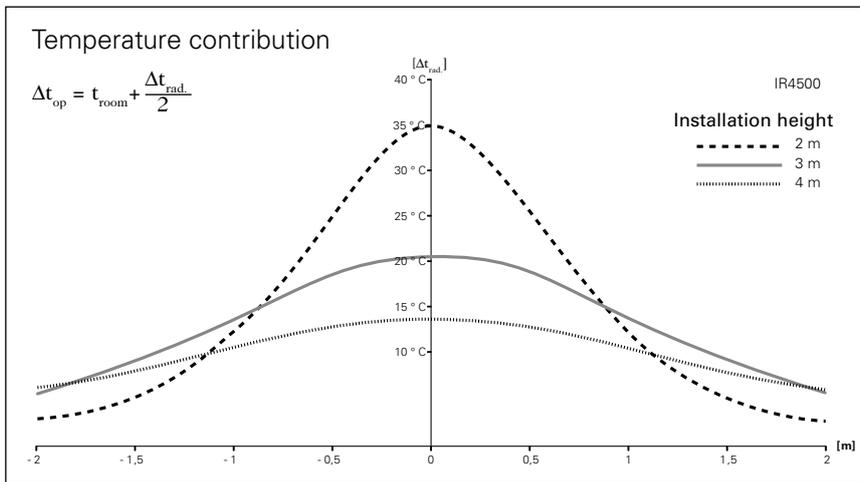
The IR heater can be mounted in an angeled position to direct the heating where it is needed. Heaters used outdoors should be placed under a roof.

To divide a large hall into different zones is very energy effective especially in buildings where each zone is sporadically used. Protection grille IRG, available as an accessory, can be used to protect the heater in for example sports centres.

Industrial infrared heater IR

Positioning, mounting and connection

Positioning
For spot heating, the infrared heaters should be positioned so that people get heat from the front and from behind. The distance to the head should not be less than 2 metres. Read more in the Technical handbook.

Mounting
Industrial infrared heater IR is installed horizontally with mounting brackets that can be installed directly against the ceiling or wall. The mounting allows the radiation angle to be adjusted 30° in each direction. The heaters can also be suspended from wire (minimum Ø 3 mm). Protection grille is available as an accessory.

Connection
Industrial infrared heater IR is intended for permanent installation. There are double connection plinths in the connection box that make it possible to further connect from one heater to another.

Heat contribution directly below IR 4.5-6 kW
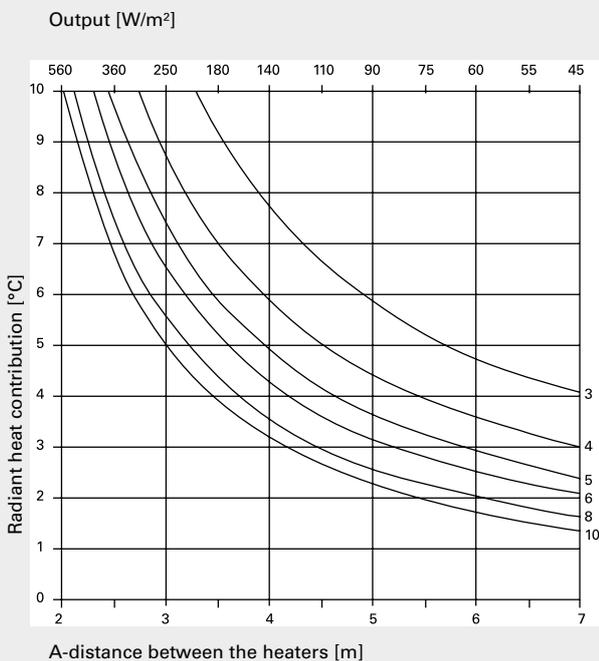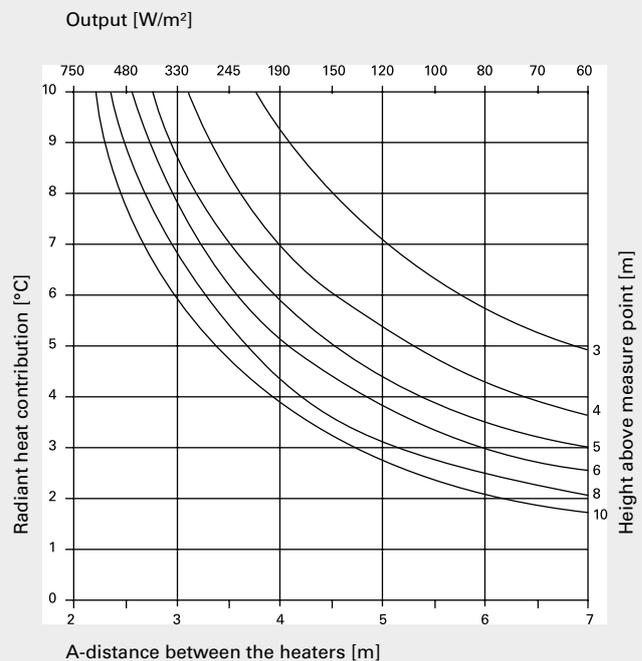
Heat contribution [°C]

Distance to IR [m]

A

2A

Radiant heat contribution IR 4,5 kW

Output [W/m²]

560   360   250   180   140   110   90   75   60   55   45

Radiant heat contribution [°C]

Height above measure point [m]

A-distance between the heaters [m]

Radiant heat contribution IR 6 kW

Output [W/m²]

750   480   330   245   190   150   120   100   80   70   60

Radiant heat contribution [°C]

Height above measure point [m]

A-distance between the heaters [m]

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection. When using TAP16R, protection class IP44 is obtained by adding a protective enclosure TEP44 and an external temperature sensor RTX54 which replaces the internal sensor. Please note that a relaybox RB is also required.

Control by thermostat
• TAP16R, electronic thermostat
• RB3, relaybox 400V3N~/400V3~

Control by thermostat and black bulb sensor
• TAP16R, electronic thermostat
• SKG30, black bulb sensor
• RB3, relaybox 400V3N~/400V3~

Control by 3 step output control and presence detector
• RB123, relaybox with 3 step output control
• PDK65, presence detector with power supply

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls and accessories

TAP16R TEP44 RTX54 SKG30 PDK65 PDK65S RB3 RB123 IRG

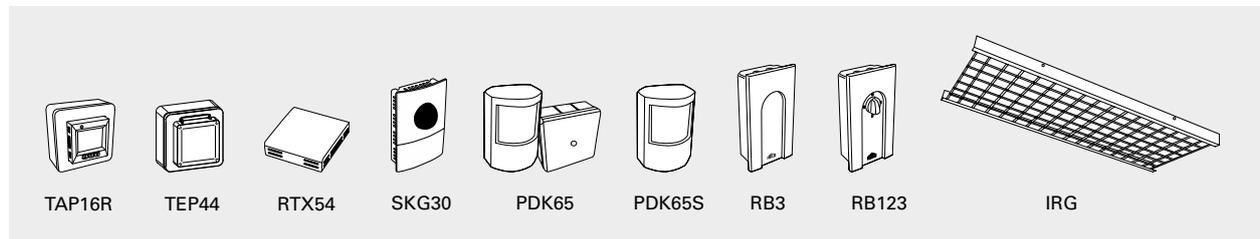| Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65	102x70x50 88x88x39
PDK65S	Additional presence detector to PDK65, IP42	102x70x50
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44	155x87x43
RB123	Relaybox with 3 step output control, 400V3N~, 16A, IP44	155x87x43
IRG3000	Protection grille for IR3000	869x362x40
IRG4500	Protection grille for IR4500	1235x362x40
IRG6000	Protection grille for IR6000	1615x362x40

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60
S123	Manual switch for 1-2-3 steps, 20A, IP42	72x64x46

KRT1900 KRTV19 S123

Halogen infrared heater IRCF

For spot heating of large premises

IRCF is especially designed for spot heating of premises with large air volumes, such as churches, aircraft hangars and marquees. With its high efficiency and compact size it is perfect for many difficult applications.

IRCF has a discreet and compact design. Equipped with one to three halogen lamps and with glossy finished reflectors.

- Equipped with one to three halogen lamps and with glossy finished reflectors.
- Easy mounting with mounting bracket on the wall or ceiling. The heater can be angled.
- Protection grille available as an accessory.
- To comply with Ecodesign Regulation (EU) 2015/1188 the unit must be installed either with thermostat TAP16R or with output control RB123 and presence detector PDK65 (accessories).
- Corrosion proof casing of aluminum.
- Colour: RAL 9006.

Halogen infrared heater IRCF (IP20)

Type	Heat output [W]	Voltage [V]	Dimensions LxHxD [mm]	Number of lamps	Weight [kg]
IRCF1500	1500	230V~	490x230x140	1	1,7
IRCF3000	3000	230V~	490x375x140	2	2,4
IRCF4500	4500	230V~/400V3~	490x515x140	3	3,0

Installation height

3–5 m

Minimum distances

Design and specifications are subject to change without notice.

Dimensions

490

140

230

490

515

IRCF can be angled.

490

375

CE
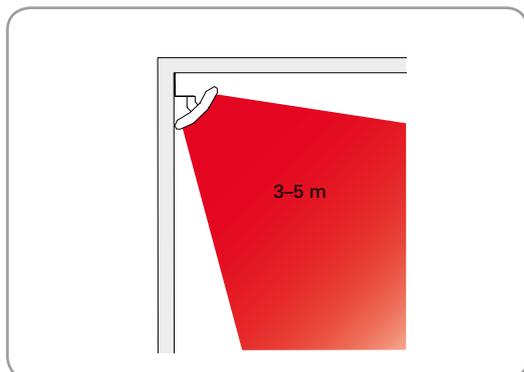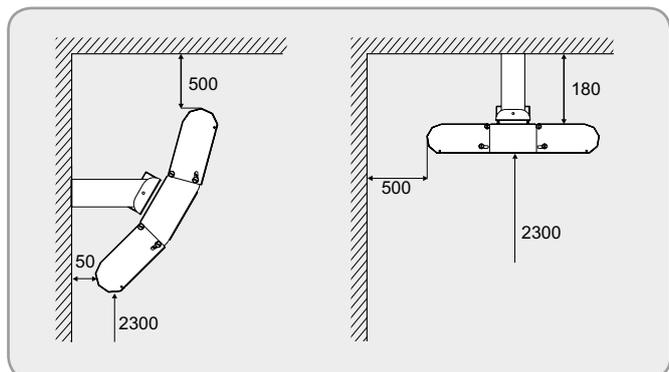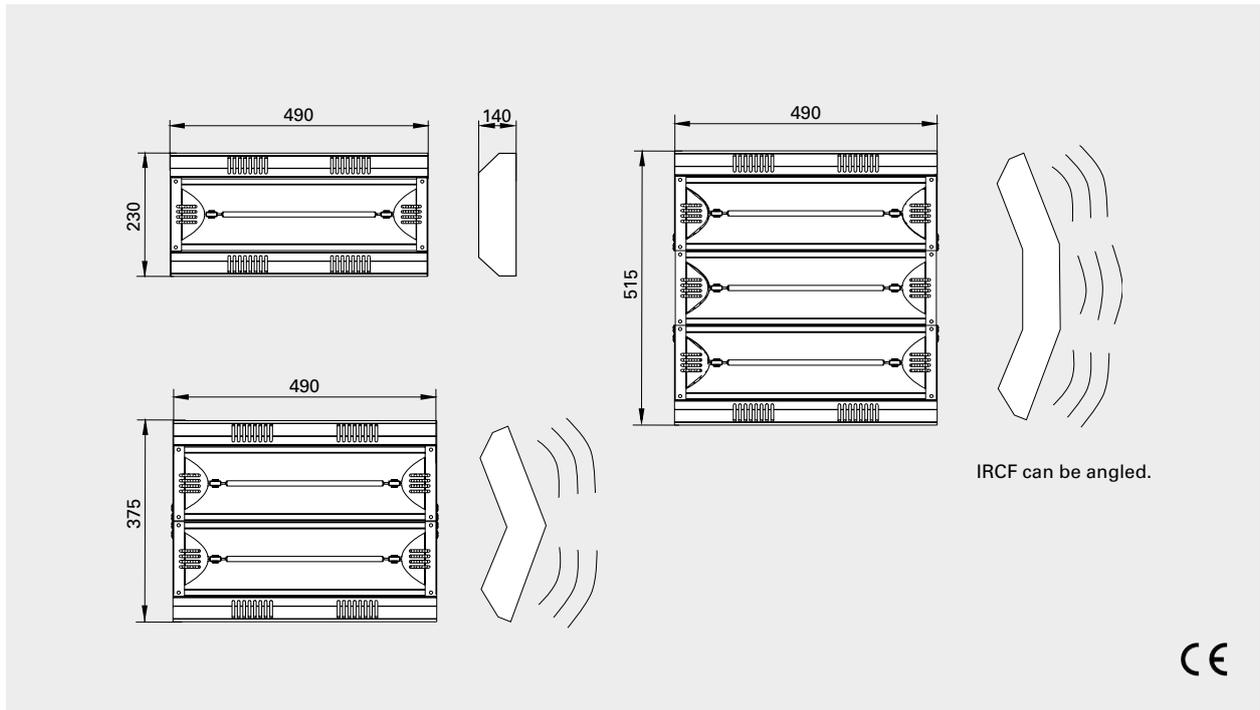
IRCF can be mounted on the wall or on the ceiling and is suitable in buildings which are used sporadically like this go-cart track starting area.

IRCF is often installed in large warehouses. They give instant and effective heat which make them profitable quickly.

Halogen infrared heater IRCF

Positioning, mounting and connection

Positioning
To heat a work station, it is suitable to use two units and let the heat flow cross.

Mounting
IRCF is installed horizontally on the ceiling or on the wall with the supplied bracket. IRCF can be suspended from chains for example. The angle of the heater can be adjusted for optimum comfort. Protection grille is available as an accessory.

Connection
IRCF is intended for permanent installation.
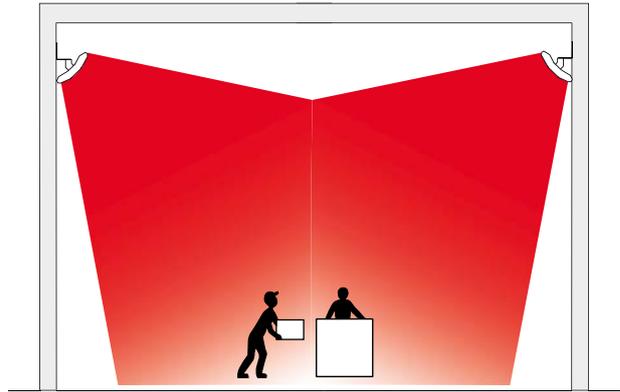
Accessories

LIRCF, extra lamp
Halogen lamps of 1,5 kW are replaceable and has a life of about 5000 hours with normal usage.

IRCG1, protection grille for IRCF
Grille to protect IRCF in exposed areas. One grille is required for IRCF1500, while IRCF3000 needs two gilles and IRCF4500 needs three grilles.
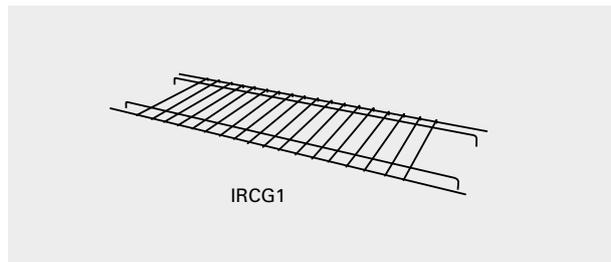
IRCG1

Type	Description	HxWxD [mm]
LIRCF	Extra lamp	
IRCG1	Protection grille for IRCF1500. IRCF3000 requires 2 pcs, IRCF4500 requires 3 pcs.	10x480x134

The smallest model of IRCF is excellent for difficult applications like churches.

Control options

The heater must be supplemented with one of the following control options. TAP16R has adaptive start, week program and open window detection.

IRCF1500 / IRCF3000

Control by thermostat
• TAP16R, electronic thermostat
• RB3, relaybox (IRCF3000)

Control by thermostat and black bulb sensor
• TAP16R, electronic thermostat
• SKG30, black bulb sensor
• RB3, relaybox (IRCF3000)

Control by thermostat and presence detector
• TAP16R, electronic thermostat
• PDK65, presence detector with power supply
• RB3, relaybox (IRCF3000)

IRCF4500

Control by thermostat
• TAP16R, electronic thermostat
• RB3, relaybox

Control by thermostat and black bulb sensor
• TAP16R, electronic thermostat
• SKG30, black bulb sensor
• RB3, relaybox

Control by 3 step output control and presence detector
• RB123, relaybox with 3 step output control
• PDK65, presence detector with power supply

The product can be controlled in a different way, e.g. by an overall control system (BMS) as long as the requirements of Ecodesign Regulation are met.

Controls

TAP16R TEP44 RTX54 SKG30 PDK65 PDK65S RB3 RB123

Type	Description	HxWxD [mm]
TAP16R	Electronic thermostat, 16A, IP21	87x87x53
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65	102x70x50 88x88x39
PDK65S	Additional presence detector to PDK65, IP42	102x70x50
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44	155x87x43
RB123	Relaybox with 3 step output control, 400V3N~, 16A, IP44	155x87x43

Controls for installations not covered by the Ecodesign Regulation (EU) 2015/1188

When the heater is used for technical heating purposes, and not as a local space heater, the following controls can be used.

Type	Description	HxWxD [mm]
KRT1900	Capillary tube thermostat, IP55	165x57x60
KRTV19	Capillary tube thermostat with knob, IP44	165x57x60
S123	Manual switch for 1-2-3 steps, 20A, IP42	72x64x46

KRT1900 KRTV19 S123

Aquaztrip Plan

Water heated radiant heater for recessed mounting in false ceilings or free hanging

Aquaztrip Plan is used for water supplied heating/ cooling systems. It can be mounted free hanging or integrated in false ceilings and perfectly suits in fine environments such as offices, shops, etc.

The panel sizes are designed to replace 600x600 mm suspended ceiling tiles. Thanks to the low installation dimensions they will fit in most suspended ceilings.

The panels are supplied complete with insulation and suspension brackets for quick installation.

- The panels are available in lengths of up to 3 metres. Width: 600 mm.
- Low installation dimensions: 40 mm.
- The copper pipes are laser welded to aluminium plates for maximum heat transfer.
- The pipe ends are bent up on delivery.
- The top of the panel is insulated with mineral wool which is covered with plastic paper for easy cleaning.
- Adjustable suspension brackets are supplied.
- Complies to EN14037.
- Heat radiation panel of powder coated aluminium. Colour: white, RAL 9003. Other colours available on request.

Aquaztrip Plan

Type	Output*[1]	Length	Width	Max operating pressure	Max operating temperature	Weight with water	Weight without water
	[W/panel]	[mm]	[mm]	[bar]	[°C]	[kg]	[kg]
AZP612	184	1190	592	10	90	4,5	4,2
AZP618	276	1790	592	10	90	6,8	6,3
AZP624	409	2390	592	10	90	9,2	8,5
AZP630	511	2990	592	10	90	11,5	10,6

*) Applicable at water temperature 60/40 °C, room temperature +20 °C.
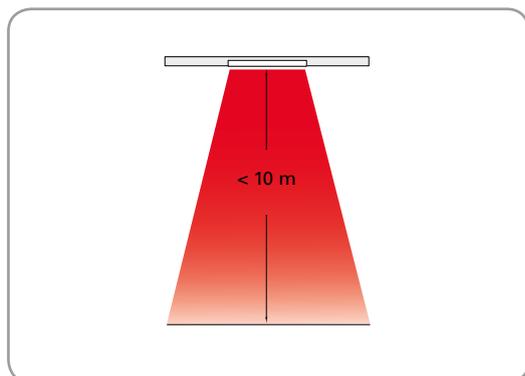
Installation height

Distance between panels

Design and specifications are subject to change without notice.

Dimensions

Panels with a width of 900 mm can be specially ordered.

	L [mm]
AZP612	1190
AZP618	1790
AZP624	2390
AZP630	2990

Connections are to plain pipe ends Ø 12 mm. Panels with a pipe diameter of 10 mm can be specially ordered.

Pressure drop
The water flow should be high ensuring turbulent flows are produced in the pipes. Recommended minimum flow: 0.02 l/s.

- AZP612
- AZP618
- AZP624
- AZP630
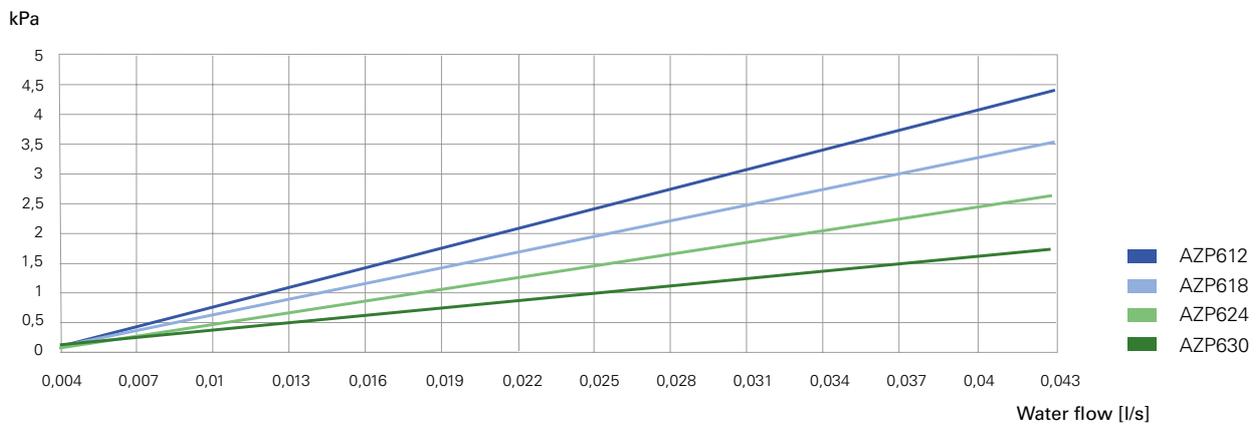
Radiant heaters are the perfect protection against cold draughts. Here the windows are protected by suspended Aquaztrip Plan with black finish.

Using the radiation principle, air is not heated directly. This results in a soft, draught-free, comfortable indoor climate and an even temperature.

Aquaztrip Flex

Flexible radiant heater with water heating

Thanks to its light and robust design, Aquaztrip Flex is ideal for offices, shops, schools etc. Flexible mounting on the ceiling, recessed or suspended.

Aquaztrip Flex has an elegant, powder coated white surface that blends in to most environments. Cover panels are available as an option for environments with high finish demands. These hide pipe couplings effectively and also join the panel lengths into one unit.

- The panels can be ordered in lengths from 1 m up to 6 m, in increments of 0.1 m, and with 3 different pipe connection options. The lengths can then be combined up to a max. of 25 m.
- Complies to EN14037.
- Optimal heat distribution. For best possible contact, the copper pipes are pressed into heat conductive paste against the aluminium panels, which are then sealed with aluminium tape and 28 mm polyurethane foam.
- Mounting components for suspension are available as an option.
- Heat radiation panel of powder coated aluminium. Colour: white, RAL 9003. Other colours available on request.
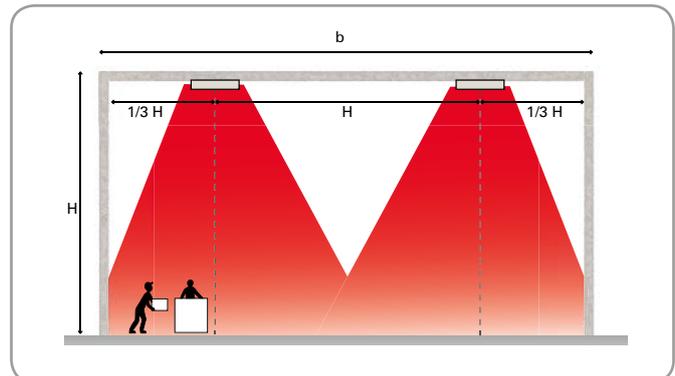
Aquaztrip Flex

Type	Output*	Width	Max operating pressure	Max operating temperature	Weight with water	Weight without water
	[W/m]	[mm]	[bar]	[°C]	[kg/m]	[kg/m]
AZF400	113	400	600	80	3,5	2,6
AZF800	225	800	600	80	7,2	5,2
AZF1200	336	1200	600	80	10,8	7,8

*) Applicable at water temperature 60/40 °C, room temperature +20 °C.
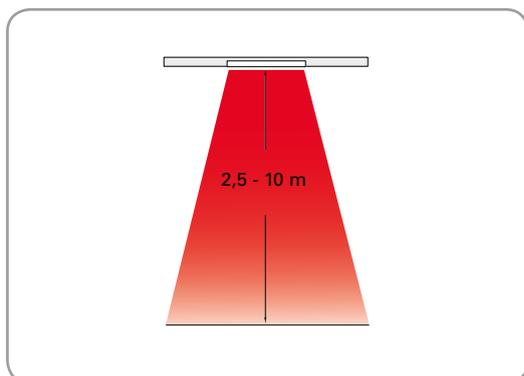
Installation height

Distance between panels

Design and specifications are subject to change without notice.

2018-06-15
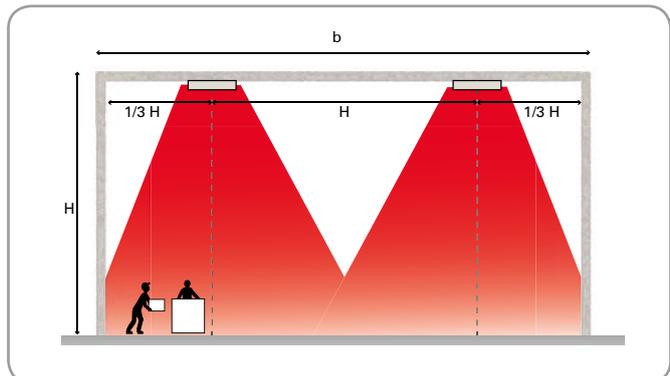
Dimensions
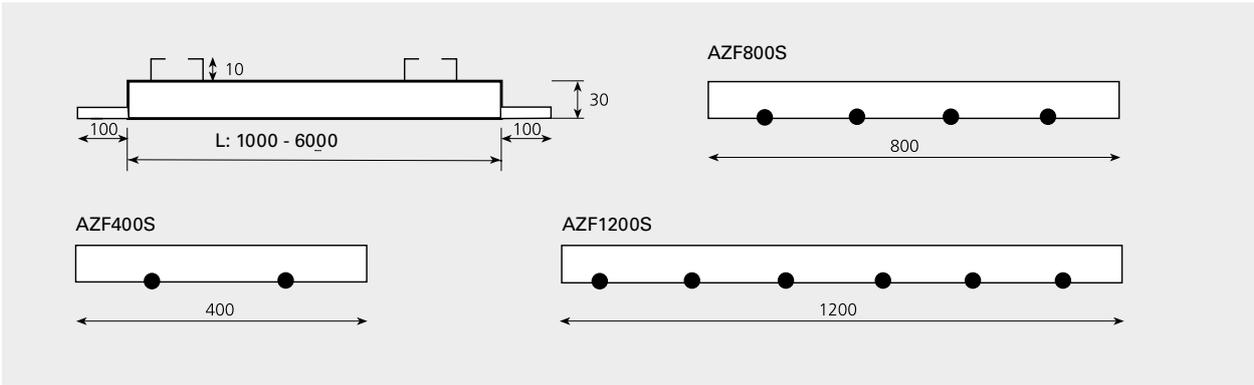
Heating output Pv (W/running metre)

The output is a function of the difference between the mean temperature of the heat carrier and the room temperature.

Type	Δt_{mv} (°C)							
	25	30	35	40	45	50	55	60
AZF400	95	115	130	150	170	195	215	235
AZF800	190	225	260	300	340	390	425	465
AZF1200	285	335	375	450	510	585	635	700

Aquaztrip is the perfect solution for premises with high ceilings.

Water flow

The water flow is a function of the heating output Pv and temperature difference in the heat carrier Δtv. The water flow should be high ensuring turbulent flows are produced in the pipes. Recommended minimum flow: 0.02 l/s.

Water connection

Connections are to plain pipe ends in the following dimensions:

Ø 12 mm	Ø 15 mm	Ø 22 mm
AZF400P	AZF400D	AZF1200D
AZF800S	AZF800P/D	
AZF1200P/S		

AZF is available in other connection options when ordering.

Aquaztrip Comfort

Powerful radiant heater for very high installation heights

Thanks to its strong construction and the option of serial connection up to 125 m, Aquaztrip Comfort is ideal for sports centres, terminals, warehouses and industrial premises as well as workshops.

Aquaztrip can provide cost savings of up to 25% compared with traditional heating systems, especially in premises that are poorly insulated, have high ceilings and are used irregularly.

- The panels are connected in series in lengths of up to approx. 125 metres. Max length per panel is 6 metres.
- Convection protection included.
- Complies to EN14037.
- The radiant heat panel consists of rolled aluminium sheet shaped around the water pipes for optimum contact and energy distribution.
- The top of the panel is insulated with mineral wool which is covered with plastic paper for easy cleaning.
- Heat radiation panel of painted aluminium. Colour: light grey, NCS S 3500 N. Other colours available on request.

Aquaztrip Comfort

Type	Output*	Width	Max operating pressure	Max operating temperature	Weight with water	Weight without water
	[W/m]	[mm]	[bar]	[°C]	[kg/m]	[kg/m]
AZC615	154	615	600	90	7,2	5,2
AZC900	237	900	600	90	10,8	7,8

*) Applicable at water temperature 60/40 °C, room temperature +18 °C.

Installation height
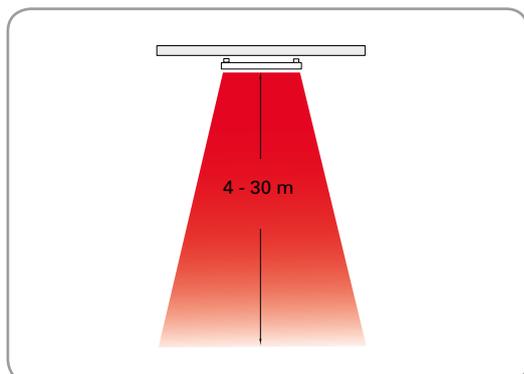
4 - 30 m

Distance between panels

b

1/3 H   H   1/3 H

H
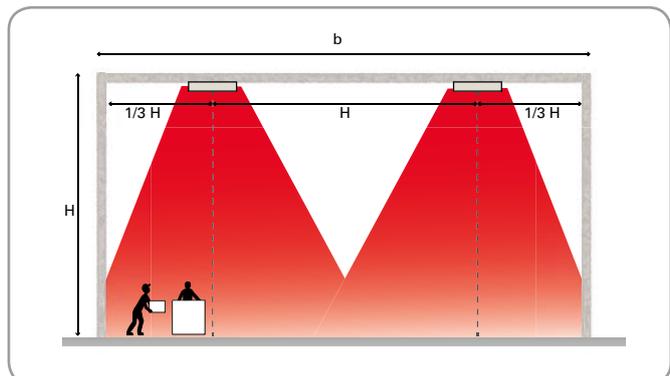
Design and specifications are subject to change without notice.
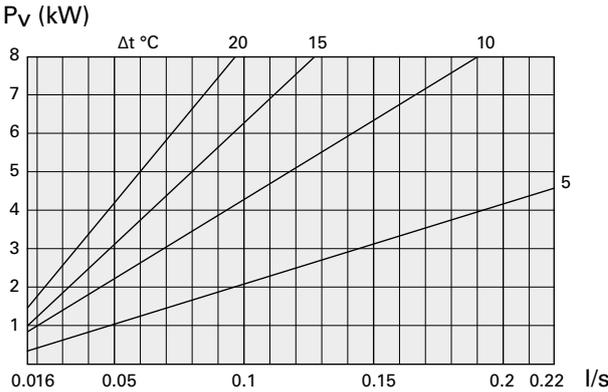
Dimensions
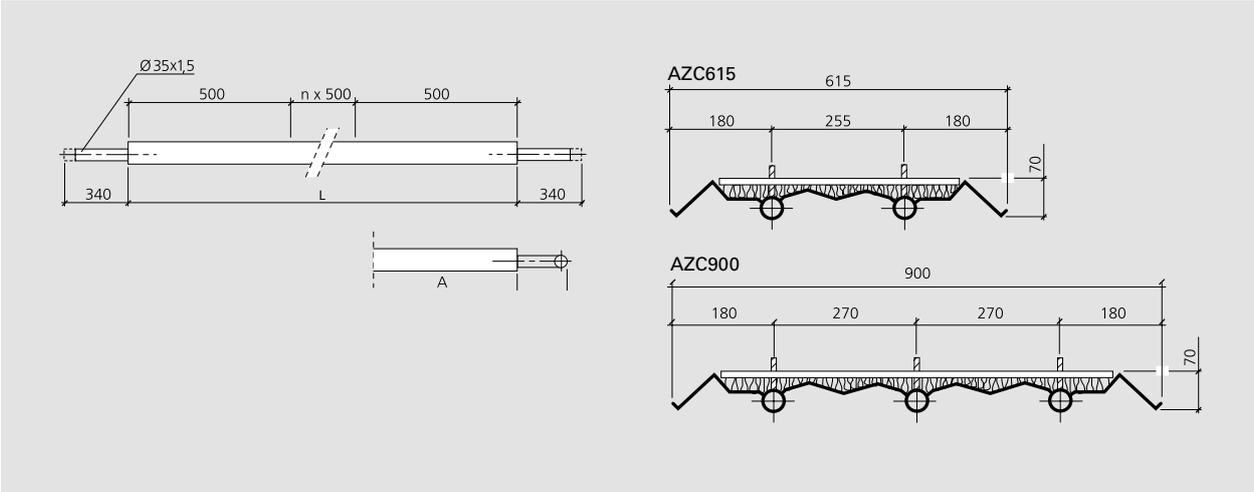
Heating output Pv (W/running metre)

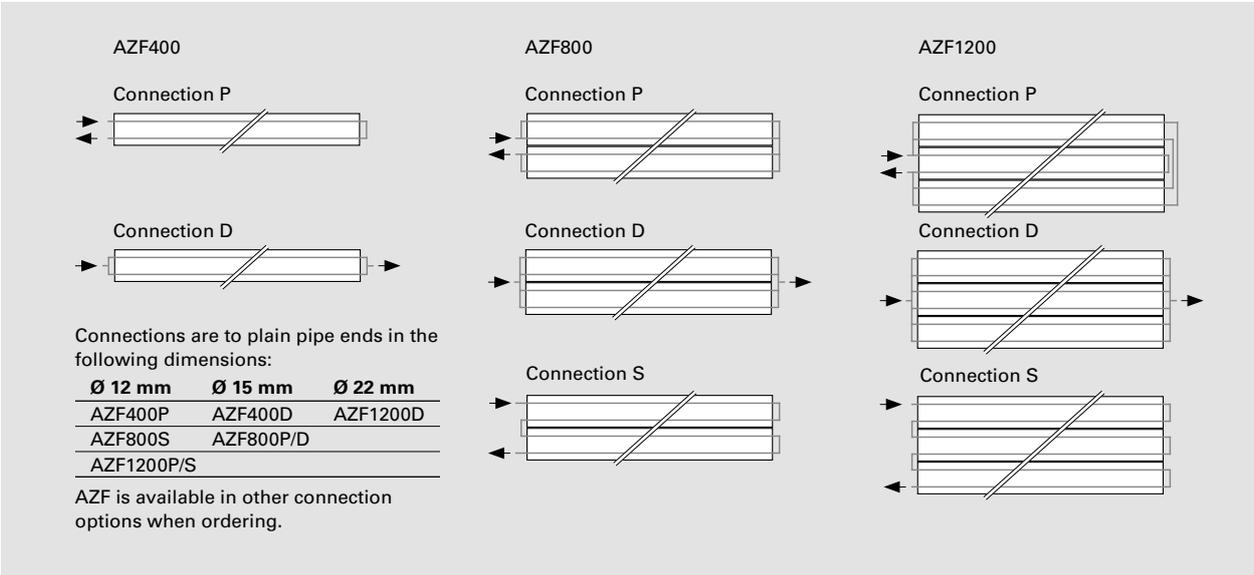The output is a function of the difference between the mean temperature of the heat carrier and the room temperature.

Type	Δt_{mv} (°C)							
	25	30	35	40	45	50	55	60
AZC615	114	142	171	200	231	261	293	325
AZC900	176	219	263	309	355	403	451	500

Water flow

The water flow is a function of the heating output Pv and temperature difference in the heat carrier Δtv. The water flow should be high ensuring turbulent flows are produced in the pipes.

Recommended minimum flow[l/s]

Connection	AZC615	AZC900
P	0,036	0,072
D	0,072	0,108
S	-	0,036

Water connection

Connections are to plain pipe ends Ø 35 mm.

Press-fit couplings of Ø 35 mm are used to interconnect panels.
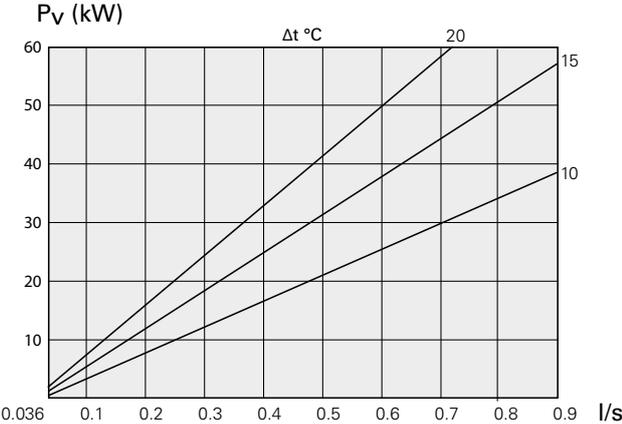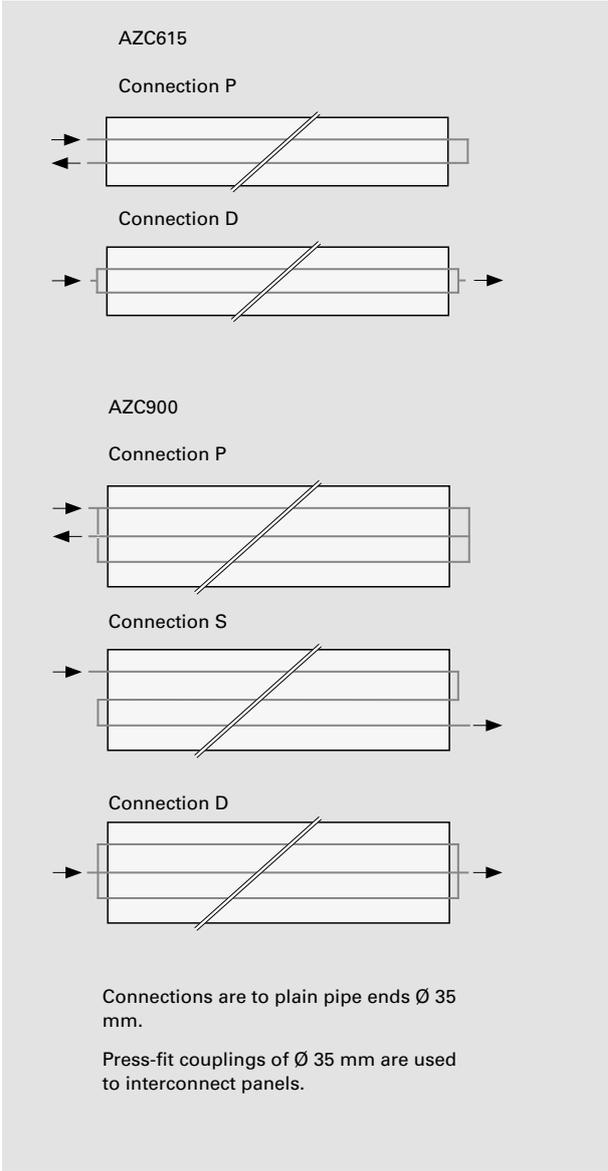
Infrared heater CIR
CIR provides comfort all year around on terraces, balconies and open-air restaurants. CIR creates no glow and is the perfect choice when you are looking for a discret solution.

Carbon infrared heater IHC
Carbon infrared heater IHC produces a gentle and direct heat which together with the soft glow, is ideal for outdoor restaurants where design is important.

Halogen infrared heater IH
The infrared heater IH is powerful with a high filament temperature of 2200 °C and is the perfect choice for exposed outdoor environments where design is important.

Infragold
Infragold is a compact, user friendly halogen infrared heater for outdoor use. Infragold is available in white, black and grey with a discreet design suitable for most environements.

Infraduo
Infraduo IHD is a halogen infrared heater incorporating LED spotlights at each end, making it very practical for all situations where both heating and light is required.

Infrasmart
Infrasmart is a compact, halogen infrared heater which can be controlled via an app, remote control (included), or built-in switch.

Infrapalm
Infrapalm is a stylish and practical freestanding heater for terraces and outdoor restaurants where there are no walls or other mounting possibilities.

Halogen infrared heater ELIR
ELIR gives an intense heat suitable for all outdoor applications. While ELIR is light, stable and portable it is well suited for temporary heating at construction sites and events.

Outdoors

Radiant heaters give an intense, comfortable heat and prolong the summer season. No moving parts mean a silent system that does not cause air movement or spread dust and other particles. Radiant heaters give instant heat, are simple and flexible to install and require minimum maintenance. People and objects are heated but not the surrounding air, which makes radiant heaters very efficient. This is especially effective outdoors. A radiant heater is also more energy efficient, safer and cleaner than a gaspowered heater.

![FRICO]
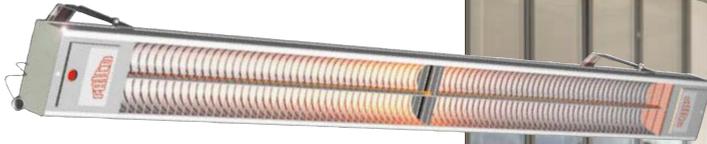
Infrared heater CIR

For applications where discreet design and operation is desired

CIR provide comfort all year around on terraces, balconies and open-air restaurants. Requires no protection against bad weather and has five-year corrosion warranty.

CIR is discreet with its slim design and silent, invisible operation and needs little space to fit in.

- Infrared heater CIR is available in three versions:
  - **CIR100** with outputs between 500 and 2000 W.
  - **CIR200** with the same outputs and built-in switch.
  - **CIRC** with output 1000 W. 1,8 m cord and plug.
- Reflectors of high-gloss polished aluminium with maximum resistance against corrosion. Grey terminal boxes of heat and weather resistant polycarbonate.
- Adjustable mounting brackets for easy mounting on the wall or ceiling.
- No risk for current leaks and thus no problem with a safety cut-out triggering off.
- Casing of white lacquered aluminium zinc panels. Colour: RAL 9002, NCS 1502-Y. Protection grille of stainless steel.

Infrared heater CIR without built-in switch (IP24)

Type	Heat output	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
CIR10521	500	230V~	2,2	750	710x44x94	1,5
CIR11021	1000	230V~	4,3	750	1250x44x94	2,2
CIR11031	1000	400V2~	2,5	750	1250x44x94	2,2
CIR11521	1500	230V~	6,5	750	1755x44x94	3,0
CIR11531	1500	400V2~	3,8	750	1755x44x94	3,0
CIR12021	2000	230V~	8,7	750	2180x44x94	3,7
CIR12031	2000	400V2~	5,0	750	2180x44x94	3,7

Infrared heater CIR with built-in switch (IP24)

Type	Heat output	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
CIR20521	500	230V~	2,2	750	710x44x94	1,5
CIR21021	1000	230V~	4,3	750	1250x44x94	2,2
CIR21031	1000	400V2~	2,5	750	1250x44x94	2,2
CIR21531	1500	400V2~	3,8	750	1755x44x94	3,0
CIR22031	2000	400V2~	5,0	750	2180x44x94	3,7

Infrared heater CIRC with 1.8 m cord and plug (IP24)

Type	Heat output	Voltage	Amperage	Max. element temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
CIR11021C	1000	230V~	4,3	750	1250x44x94	2,2

Design and specifications are subject to change without notice.

Installation height

2–2,5 m

2–2,5 m

Minimum distances

150

300

700

1800

150

Flammable material

Dimensions

A

B

137

94

44
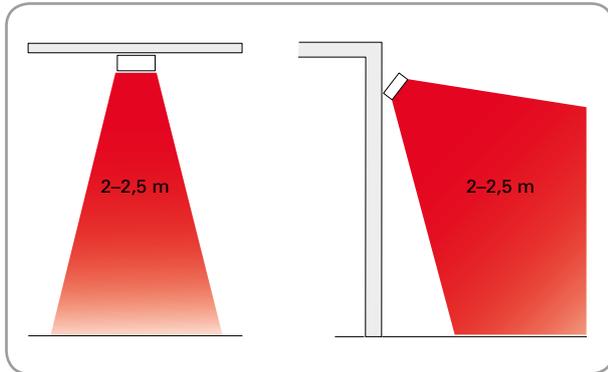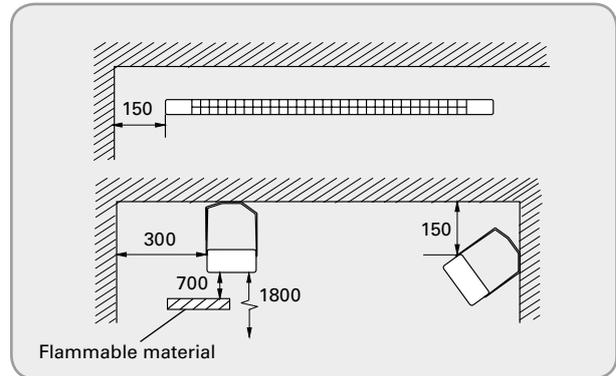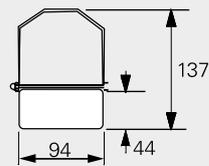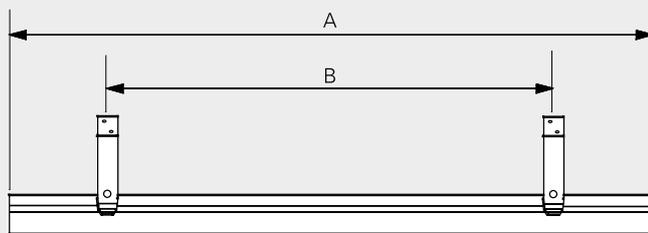
	A [mm]	B*¹ [mm]	B$_{MIN}$ *² [mm]
CIR105/205	710	500	300
CIR110/210	1250	900	600
CIR115/215	1755	1200	800
CIR120/220	2180	1500	1000

*¹) Recommendation
*²) Minimum distances between brackets

CE

Temperature contribution

$$\Delta t_{op} = t_{room} + \frac{\Delta t_{rad.}}{2}$$

[$\Delta t_{rad.}$]

18 °C
16 °C
14 °C
12 °C
10 °C
8 °C
6 °C
4 °C
2 °C

CIR

- - - 1 m
——— 2 m
········· 3 m

- 2   - 1,5   - 1   - 0,5   0   0,5   1   1,5   2   [m]
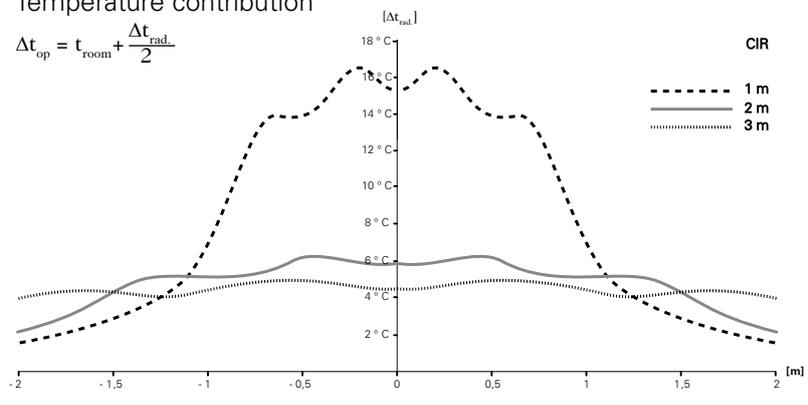
CIR is easy to fit in with its slim design. The heaters should heat from at least two directions for an even heating.

Positioning, mounting and connection

Positioning
The heaters must be placed so that they enclose the area to be heated, see fig. 1 and 2. The normal assembly height is 2–2,5 metres above the ground/floor. A rule of thumb for infrared heaters equipped with metal tubular elements is that 750–1000 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 1000 W/m² should be installed. 750 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. A green house for example requires 250-300 W/m². Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
CIR is installed horizontally on the ceiling or on the wall with the supplied adjustable mounting brackets. The angle of the heater can be adjusted for optimum comfort. The standard brackets cannot be used for angled installation on the ceiling, because the distance then becomes less than the minimum distance. CIR can also be suspended by wire.

Connection
CIR11021C is equipped with 1.8 m cord and plug for connection to an earthed outlet socket. Other models are intended for fixed installation. The heaters are approved for serial connection.
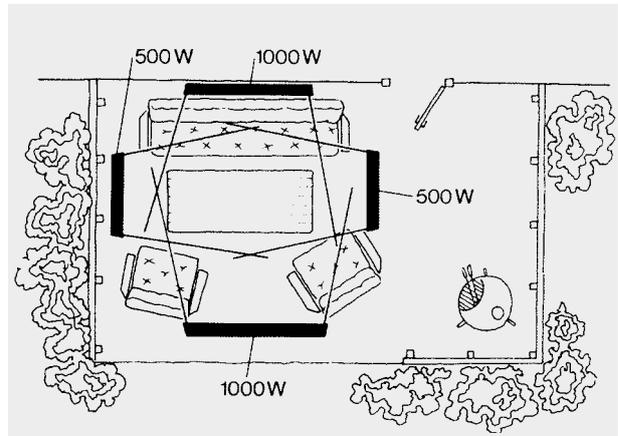
Good example of positioning, seen from above. Output requirements approx. 1000 W/m².
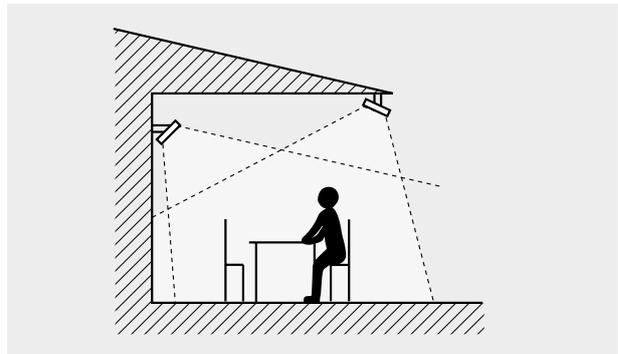
The heaters should heat from at least two directions for an even heating.

Extra heat contribution

Δ **t [°C]**   Heaters mounted in series

Mounting height [m]

CC-distance between the heaters [m]
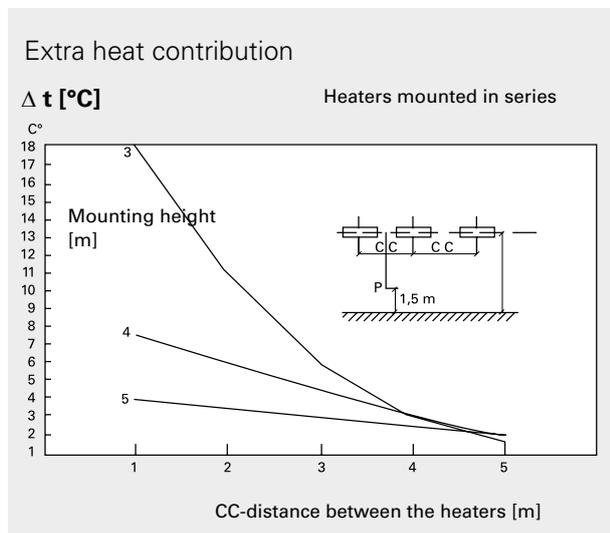
Radiant heaters are the perfect outdoor solution as they heat people and objects directely, not the surrounding air.

Control options

Output control with timer
Stepless control especially suitable for spot and zone heating. The heat contribution is controlled for best comfort. Built-in timer is set to desired time.

• CIRT, stepless output control with timer

Control with timer
The timer can be set to desired time. If the load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

• CBT, electronic timer

Beside these controls, electric heating control ERP can be used to limit the output indoors or in glassed-in areas.

Controls
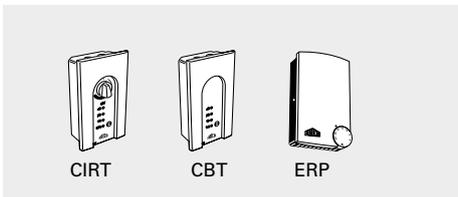
Type	Description	HxWxD [mm]
CIRT	Stepless output control with timer, IP44	155x87x43
CBT	Electronic timer, IP44	155x87x43
ERP	Electric heating control, IP20	157x93x40

Controls for CIR 1500W and 2000W when used indoors

Infrared heater CIR can also be used indoors for temporary heat contribution, but please note that models 1500W and 2000W must be installed with thermostat TAP16R (accessory) to comply with Ecodesign Regulation (EU) 2015/1188. Models of less than 1200W, however, can be used indoors with the same controls that are used outdoors. (CIR 500W, 1000W). See above.

Type	Description
TAP16R	Electronic thermostat, 16A, IP21
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54
SKG30	Black bulb sensor, NTC10KΩ, IP30
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65
PDK65S	Additional presence detector to PDK65, IP42
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44

For further information and options, see the "Controls" section.

CIR is an ideal solution for giving comfort to customers at outdoor restaurants. The heaters can be mounted on the restaurant's wall or in line directly above the tables in large terraces.

![FRICO logo]

Carbon infrared heater IHC

For soft and effective heat

Carbon infrared heater IHC produces a gentle and direct heat which together with the soft glow, is ideal for outdoor restaurants where design is important. IHC has a heat distribution best suited for close and slightly higher installations.

IHC is easy to position thanks to its compact design. The discreet and appealing look makes it suitable for outdoor environments with design demands.

- IHC consists of a carbon lamp, yellow-orange glow, with high intensity and a highly-polished reflector for optimum heat distribution.
- Bracket for wall mounting. Can also be suspended from the ceiling or mounted on a post. Other mounting alternatives are available as accessories.
- Equipped with a 0.9 metre cord with plug for connection to an earthed outlet socket.
- Casing in anodised aluminium, grille in Nickel/Chrome plating, end caps in powder-coated light-alloy metal. Colour: RAL 9006.

Carbon infrared heater IHC (IP44)

Type	Heat output [W]	Voltage [V]	Amperage [A]	Max. filament temperature [°C]	Dimensions LxHxW [mm]	Weight [kg]
IHC12	1150	230V~	5,0	1200	500x77x169	1,9
IHC18	1750	230V~	7,6	1200	676x77x169	2,5

Installation height

1,8 -2,5 m   2– 3 m

Minimum distances

200   180   160   300   500
min 30°
1000
1800
Flammable material

Design and specifications are subject to change without notice.

Dimensions

500/676   160   0,9   169   77   147

Wall bracket

CE

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
IHC is installed horizontally on walls with supplied bracket. The heater can be angled up to 45°. The heater can also be mounted on e.g. a parasol or a post, a suitable U-bolt (not included) is used for this together with the supplied console. For ceiling installation use ceiling bracket IHE (accessory). For other mounting alternatives, see accessories.

Connection
IHC is equipped with a 0.9 metre cord with plug for connection to an earthed outlet socket.
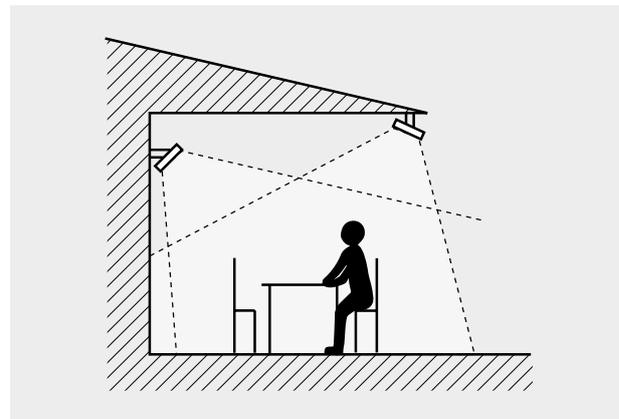
Fig. 1: The heaters should heat from at least two directions for even heating.

The intensive carbon infrared heater and a highly-polished reflector gives optimum heat distribution combined with a soft glow.

Carbon infrared heater IHC

Accessories

IHE   IHT+IHTW   IHAF

IHUB   IHXH   IHXL   IHP   IHP+IHT   BHSS-3   KLS1KS

IHUB, universal bracket
A bracket that makes it easy to even angle IH/IHC sideways. The bracket also allows mounting on, for example, a windbreak when the clamping screw is used.

IHE, ceiling bracket
Used to secure the IH/IHC in the ceiling.

IHXH, drooping extension bracket for high level mounting
Used to install IH/IHC at high level, such as above a window. Wall bracket included.

IHXL, arching extension bracket for low level mounting
Used to install IH/IHC at low level, such as on a windbreak. Wall bracket included.

IHT, triple bracket
Three IH/IHC units can be mounted on the IHT bracket to provide heat in all directions. Can be suspended from the ceiling by three wires or mounted on an IHP post. Used for IH10, IH15 and IHC12.

IHTW, wire kit
Set of three bright galvanized wires for easy hanging of IHT.

IHP, post for freestanding installation
Post to stand IH/IHC on the floor. IHP has a fixed length of 2.3 m and can be cut to desired length. The IHT triple bracket can be attached to provide heat in all directions. IH/IHC can also be mounted directly on the post using a standard bracket and a U-bolt.

BHSS-3, floor stand
Floor stand for portable use. Height up to 2.1 m.

KLS1KS, bracket with velcro
Bracket with velcro for quick and flexible mounting under a parasol or an awning.

IHAF, adapter mounting
Adapter mounting to fix IH/IHC on floor stand BHSS-3 and bracket KLS1KS.

Type	Description
IHUB	Universal bracket for IH
IHE	Ceiling bracket
IHXH	Extension bracket for high level mounting
IHXL	Extension bracket for low level mounting
IHT	Triple bracket
IHTW	Wire kit (3 wires) for IHT
IHP	Post for freestanding installation, 2,3 m
BHSS-3	Floor stand, up to 2.1 m
KLS1KS	Bracket with velcro
IHAF	Adapter mounting for KLS1KS and BHSS-3

With an extension bracket, the heater can be positioned lower than its mounting point.

Control options

Timer control
The timer can be set to a desired time. If the current load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

• CBT, electronic timer

Comfort control
The comfort controller allows you to wirelessly control one or more infrared heaters via an app (iOS or Android) or by using the remote control supplied. The IHBD3 offers stepless control via the Frico Infra app, or 5 step regulation when using the remote control.

• IHBD3, comfort controller

Type	Description
IHBD3	Comfort controller for infrared heater, 3000W, 230V~, IP65
CBT	Electronic timer, IP44

Controls for IHC 1800W when used indoors

Infrared heater IHC also be used indoors for temporary heat contribution, but please note that model IHC18 must be installed with thermostat TAP16R (accessory) to comply with Ecodesign Regulation (EU) 2015/1188. Models of less than 1200W, however, can be used indoors with the same controls that are used outdoors. (IHC12). See above.

Type	Description
TAP16R	Electronic thermostat, 16A, IP21
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54
SKG30	Black bulb sensor, NTC10KΩ, IP30
PDK65	Presence detector with power supply (up to 5 detectors), 230V~, max 2,3 kW, IP42/IP65
PDK65S	Additional presence detector to PDK65, IP42
RB3	Relaybox 400V3N~ (400V3~/V2~, 230V3~/V2~), 16A, IP44

For further information and options, see the "Controls" section.

IHC is ideal for environments where design is important and has a heat distribution best suited for close and slightly higher installations.

FRICO
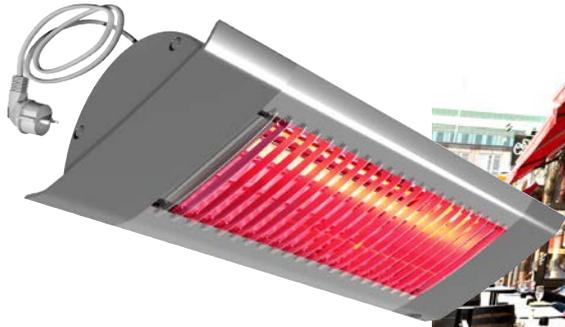
Halogen infrared heater IH

Suitable for exposed outdoor environments with design demands

The infrared heater IH is powerful with a high filament temperature of 2200 °C and is the perfect choice for exposed outdoor environments where design is important. IH is available in two different designs. IHW gives a comfortable heat in the occupied zone from close range and also wider heat distribution. IHF has more direct heat distribution and is designed to be installed higher up.

IH is easy to position thanks to its compact design. The discreet and appealing look makes it suitable for outdoor environments with design demands.

- IH is available in two versions:
  - **IHW** provides wide heat distribution (60°), recommended installation height 1.8 – 2.5 m.
  - **IHF** provides directed heat distribution (40°), recommended installation height 2.3 – 3.5 m.
- IH consists of a halogen lamp with a faint red glow and a very high intensity and a highly-polished reflector for optimum heat distribution.
- Bracket for wall mounting. Can also be suspended from the ceiling or mounted on a post. Other mounting alternatives are available as accessories.
- Equipped with a 0.9 metre cord with plug for connection to an earthed outlet socket.
- Casing in anodised aluminium, grille in Nickel/Chrome plating, end caps in powder-coated light-alloy metal. Colour: RAL 9006.

Infrared heater IHW with wide heat distribution (IP44)

Type	Heat output	Voltage	Amperage	Max. filament temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
IHW10	1000	230V~	4,3	2200	500x77x169	1,9
IHW15	1500	230V~	6,5	2200	500x77x169	1,9
IHW20	2000	230V~	8,7	2200	676x77x169	2,5

Infrared heater IHF with directed heat distribution (IP44)

Type	Heat output	Voltage	Amperage	Max. filament temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
IHF10	1000	230V~	4,3	2200	500x77x169	1,9
IHF15	1500	230V~	6,5	2200	500x77x169	1,9
IHF20	2000	230V~	8,7	2200	676x77x169	2,5

Design and specifications are subject to change without notice.

2018-06-15

Installation height

1,8 -2,5 m   2,3 – 3,5 m

Minimum distances

200   180   160   500

min 30°   300

1800   1000

Flammable material

Dimensions

0,9   160

500/676   77   147   169

Wall bracket

CE
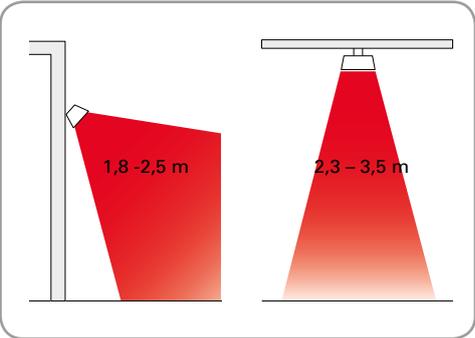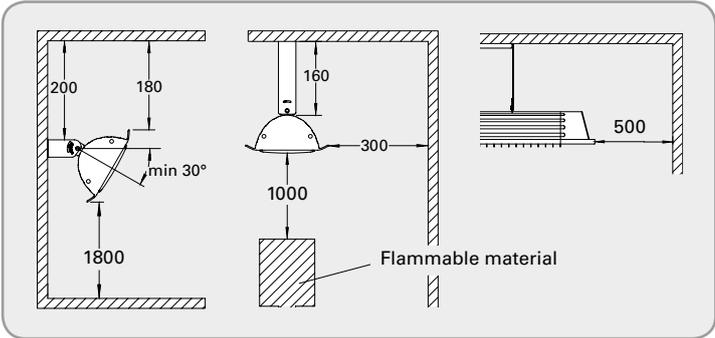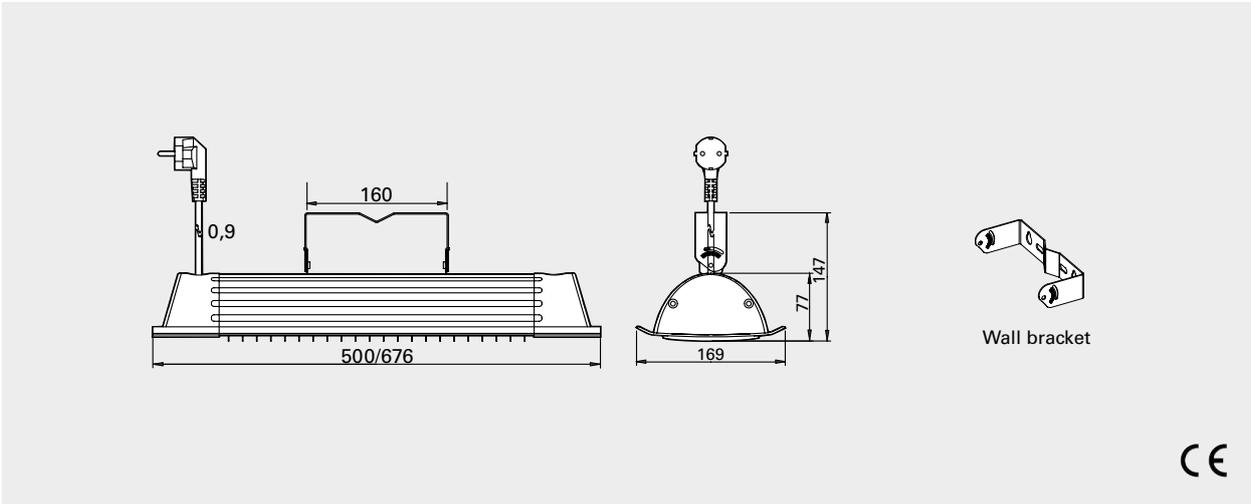
Thanks to a high temperature of 2200 °C and the adapted reflector, IH is extremely efficient and provides a comfortable heat.

Radiant heaters give an intense, comfortable heat and prolong the summer season.

Halogen infrared heater IH

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
IH is installed horizontally on walls with supplied bracket. The heater can be angled up to 45°. The heater can also be mounted on e.g. a parasol or a post, a suitable U-bolt (not included) is used for this together with the supplied console. For ceiling installation use ceiling bracket IHE (accessory). For other mounting alternatives, see accessories.

Connection
IH is equipped with a 0.9 metre cord with plug for connection to an earthed outlet socket.
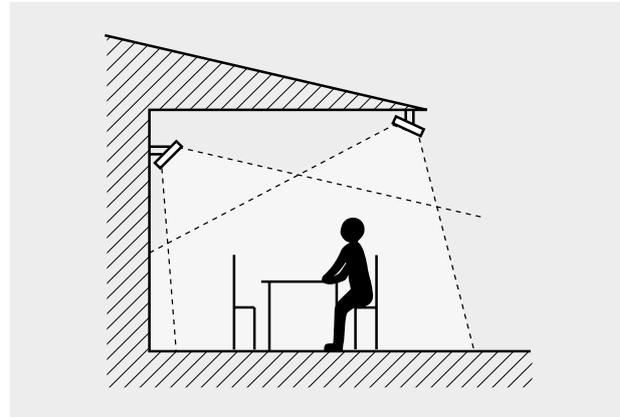
Fig. 1: The heaters should heat from at least two directions for even heating.

Post for floor mounting available as an option. With a triple bracket, three infrared heaters can be positioned on the same post so that heat can be directed in all directions.

Control options

Timer control
The timer can be set to a desired time. If the current load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

• CBT, electronic timer

Comfort control
The comfort controller allows you to wirelessly control one or more infrared heaters via an app (iOS or Android) or by using the remote control supplied. The IHBD3 offers stepless control via the Frico Infra app, or 5 step regulation when using the remote control.

• IHBD3, comfort controller

IHBD3   CBT

Type	Description
IHBD3	Comfort controller for infrared heater, 3000W, 230V~, IP65
CBT	Electronic timer, IP44

For further information and options, see the "Controls" section.

Accessories

IHE   IHT+IHTW   IHAF

IHUB   IHXH   IHXL   IHP   IHP+IHT   BHSS-3   KLS1KS

IHUB, universal bracket
A bracket that makes it easy to even angle IH/IHC sideways. The bracket also allows mounting on, for example, a windbreak when the clamping screw is used.

IHE, ceiling bracket
Used to secure the IH/IHC in the ceiling.

IHXH, drooping extension bracket for high level mounting
Used to install IH/IHC at high level, such as above a window. Wall bracket included.

IHXL, arching extension bracket for low level mounting
Used to install IH/IHC at low level, such as on a windbreak. Wall bracket included.

IHT, triple bracket
Three IH/IHC units can be mounted on the IHT bracket to provide heat in all directions. Can be suspended from the ceiling by three wires or mounted on an IHP post. Used for IH10, IH15 and IHC12.

IHTW, wire kit
Set of three bright galvanized wires for easy hanging of IHT.

IHP, post for freestanding installation
Post to stand IH/IHC on the floor. IHP has a fixed length of 2.3 m and can be cut to desired length. The IHT triple bracket can be attached to provide heat in all directions. IH/IHC can also be mounted directly on the post using a standard bracket and a U-bolt.

BHSS-3, floor stand
Floor stand for portable use. Height up to 2.1 m.

KLS1KS, bracket with velcro
Bracket with velcro for quick and flexible mounting under a parasol or an awning.

IHAF, adapter mounting
Adapter mounting to fix IH/IHC on floor stand BHSS-3 and bracket KLS1KS.

Type	Description
IHUB	Universal bracket for IH
IHE	Ceiling bracket
IHXH	Extension bracket for high level mounting
IHXL	Extension bracket for low level mounting
IHT	Triple bracket
IHTW	Wire kit (3 wires) for IHT
IHP	Post for freestanding installation
BHSS-3	Floor stand, up to 2.1 m
KLS1KS	Bracket with velcro
IHAF	Adapter mounting for KLS1KS and BHSS-3

With an extension bracket, the heater can be positioned lower than its mounting point.

FRICO

Infragold

Halogen infrared heater for long-lasting, comfort heating

Infragold is a compact, user friendly halogen infrared heater for outdoor use. It is equipped with a gold infrared tube and cord with plug for easy installation.

Infragold is available in white, black and grey with a discreet design suitable for most environoments.

- Halogen lamp with gold infrared tube and polished aluminium reflector.
- Wall bracket included. Other mounting alternatives are available as accessories, e.g. ceiling bracket and floor stand.
- Equipped with a 1.9 metre cord with plug for connection to an earthed outlet socket.
- Casing in powder-coated aluminium. Colours: white RAL9010, black RAL9005 or grey RAL7016.

Infragold (IP44)

Type	Heat output [W]	Voltage [V]	Colour	Max. filament temperature [°C]	Dimensions LxHxW [mm]	Weight [kg]
IHG10W	1000	230V~	White	1800	464x125x95	2,1
IHG10B	1000	230V~	Black	1800	464x125x95	2,1
IHG10G	1000	230V~	Grey	1800	464x125x95	2,1

Installation height

1,8–2,5 m

2–3 m

Minimum distances

1000

500

1000

150

45° (+/- 10°)

1800

Flammable material

Dimensions

T-bracket included

231

464

95

125

165

80

55

CE

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
IHG is installed horizontally on walls with supplied bracket. The heater can be angled up to 45°. For other mounting alternatives, e.g. in the ceiling, on a floor stand, under a parasol or awning, see accessories.

Connection
IHG is equipped with a 1.9 metre cord with plug for connection to an earthed outlet socket.

Fig. 1: The heaters should heat from at least two directions for even heating.

Infragold

Control options

Timer control
The timer can be set to a desired time. If the current load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

• CBT, electronic timer

Comfort control
The comfort controller allows you to wirelessly control one or more infrared heaters via an app (iOS or Android) or by using the remote control supplied. The IHBD3 offers stepless control via the Frico Infra app, or 5 step regulation when using the remote control.

• IHBD3, comfort controller

IHBD3   CBT

Type	Description
IHBD3	Comfort controller for infrared heater, 3000W, 230V~, IP65
CBT	Electronic timer, IP44

For further information and options, see the "Controls" section.

Accessories

T-bracket included

KLS1KS   BHSS-3   BCDF   BCSF   MB4040200

KLS1KS, bracket with velcro
Bracket with velcro for quick and flexible mounting under a parasol or an awning. Use with BCSF for infrared heater with T bracket.

BHSS-3, floor stand
Floor stand for portable use. Height up to 2.1 m. Use with BCSF for infrared heater with T bracket.

BCSF, adapter mounting
Adapter mounting to fix infrared heaters with T bracket on accessories, such as BHSS-3 and KLS1KS.

BCDF, ceiling bracket
Used to secure the infrared heater in the ceiling.

MB4040200, awning bracket
Used to install infrared heaters with T bracket under an awning.

Type	Description
KLS1KS	Bracket with velcro
BHSS-3	Floor stand, up to 2.1 m
BCSF9010	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, white
BCSF9005	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, black
BCSF7016	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, grey
BCDF209010	Ceiling bracket, 200 mm, white
BCDF209005	Ceiling bracket, 200 mm, black
BCDF207016	Ceiling bracket, 200 mm, grey
MB40402009010	Awning bracket for infrared heater with T bracket, 200 mm, white
MB40402009005	Awning bracket for infrared heater with T bracket, 200 mm, black
MB40402007016	Awning bracket for infrared heater with T bracket, 200 mm, grey

FRICO

Infraduo

Halogen infrared heater with the perfect combination of heating and lighting

Infraduo IHD is a halogen infrared heater incorporating LED spotlights at each end, making it very practical for all situations where both heating and light is required.

The LED spotlights can be rotated through 180° and are controlled separately from the heating.

Infraduo has an attractive design in polished aluminium alowing easy placement in any environment. With its high IP class, it is also suitable for use in high humidity conditions.

- Fitted with dual LED spotlights (2x3.5W) which can be rotated through 180°.
- Heating and lights are controlled individually.
- Halogen lamp with gold infrared tube and polished aluminium reflector.
- High protection class, IP65.
- Wall bracket included. Other mounting alternatives are available as accessories, e.g. ceiling bracket and floor stand.
- Polished aluminium housing.

Infraduo (IP65)

Type	Heat output	Voltage	Max. filament temperature	Dimensions LxHxW	Weight
	[W]	[V]	[°C]	[mm]	[kg]
IHD17	1650	230V~	1800	825x125x95	3,4
IHD20	2000	230V~	1800	825x125x95	3,4

Installation height
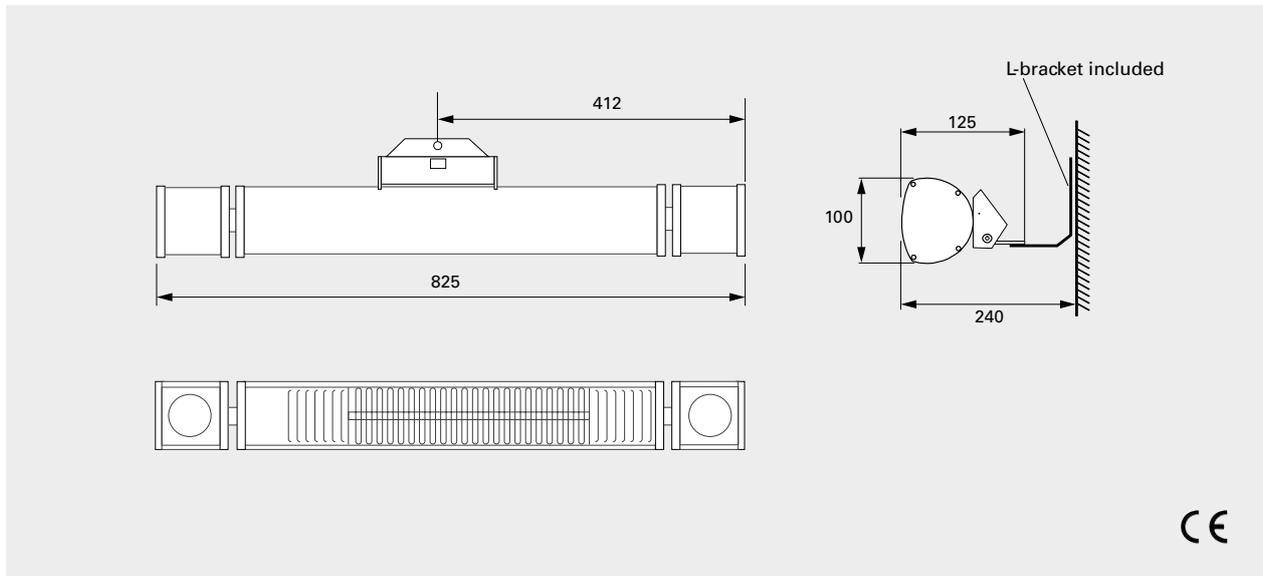
Minimum distances

Design and specifications are subject to change without notice.

2018-06-15

Infraduo

Dimensions

412

825

125

100

240

L-bracket included

CE

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
IHD is installed horizontally on walls with supplied bracket. The heater can be angled up to 45°. For other mounting alternatives, e.g. in the ceiling, on a floor stand, under a parasol or awning, see accessories.

Connection
IHD is intended for permanent installation.

Fig. 1: The heaters should heat from at least two directions for even heating.

Control options

Timer control
The timer can be set to a desired time. If the current load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

- CBT, electronic timer

Comfort control
The comfort controller allows you to wirelessly control one or more infrared heaters via an app (iOS or Android) or by using the remote control supplied. The IHBD3 offers stepless control via the Frico Infra app, or 5 step regulation when using the remote control.

- IHBD3, comfort controller

IHBD3   CBT

Type	Description
IHBD3	Comfort controller for infrared heater, 3000W, 230V~, IP65
CBT	Electronic timer, IP44

For further information and options, see the "Controls" section.

Accessories

L-bracket included

KLS1KS   BHSS-3   BCDF

KLS1KS, bracket with velcro
Bracket with velcro for quick and flexible mounting under a parasol or an awning.

BHSS-3, floor stand
Floor stand for portable use. Height up to 2.1 m.

BCDF, ceiling bracket
Used to secure the infrared heater in the ceiling.

Type	Description
KLS1KS	Bracket with velcro
BHSS-3	Floor stand, up to 2.1 m
BCDF209010	Ceiling bracket, 200 mm, white
BCDF209005	Ceiling bracket, 200 mm, black
BCDF207016	Ceiling bracket, 200 mm, grey

Infrasmart IP67

Infrasmart IP24

Infrasmart

Halogen infrared heater with smart functions

Infrasmart is a compact, halogen infrared heater which can be controlled via an app, remote control (included), or built-in switch.

The Frico Infra app is available for iOS and Android and with a range of 50 m can control up to 8 infrared heaters.

Infrasmart is available in several IP classes and colours. They are suitable for balconies, outdoor areas and terraces.

- Infrasmart is available in the following versions:
  - **Infrasmart IP67**: 1.5-2 kW, reduced glow. Colours: white RAL9010, black RAL9005 or grey RAL7016.
  - **Infrasmart IP24**: 2 kW. Colours: white RAL9010, black RAL9005 or silver RAL9006.
- Remote control included, for regulation in 5 steps. Can also be controlled via the Frico Infra app. Built-in switch.
- Halogen lamp with polished aluminium reflector.
- Wall bracket included. Other mounting alternatives are available as accessories, e.g. ceiling bracket and floor stand.
- Equipped with a 1.9 metre cord with plug for connection to an earthed outlet socket.
- Casing in powder-coated aluminium.

Infrasmart IP67, reduced glow (IP67)

Type	Heat output [W]	Voltage [V]	Colour	Max. filament temperature [°C]	Dimensions LxHxW [mm]	Weight [kg]
IHS15W67	1500	230V~	White	1800	710x125x100	2,5
IHS15B67	1500	230V~	Black	1800	710x125x100	2,5
IHS15G67	1500	230V~	Grey	1800	710x125x100	2,5
IHS20W67	2000	230V~	White	1800	710x125x100	2,5
IHS20B67	2000	230V~	Black	1800	710x125x100	2,5
IHS20G67	2000	230V~	Grey	1800	710x125x100	2,5

Infrasmart IP24 (IP24)

Type	Heat output [W]	Voltage [V]	Colour	Max. filament temperature [°C]	Dimensions LxHxW [mm]	Weight [kg]
IHS20W24	2000	230V~	White	1800	480x112x145	2,5
IHS20B24	2000	230V~	Black	1800	480x112x145	2,5
IHS20S24	2000	230V~	Silver	1800	480x112x145	2,5

Design and specifications are subject to change without notice.

2018-06-15

Installation height

1,8–2,5 m

2–3,5 m

Minimum distances

1000

500

1000

Flammable material

1,5 kW: 150
2kW: 200

45° (+/- 10°)

1,5 kW: 1800
2 kW: 2100

Dimensions

Infrasmart IP67

305

690

710

T-bracket included

100

80

125

165

Operation range of IR-remote: 120°

55

Infrasmart IP24

33

112

480

M8

L-bracket included

145

Operation range of IR-remote: 120°

145

480

CE

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
IHS is installed horizontally on walls with supplied bracket. The heater can be angled up to 45°. For other mounting alternatives, e.g. in the ceiling, on a floor stand, under a parasol or awning, see accessories.

Connection
IHS is equipped with a 1.9 metre cord with plug for connection to an earthed outlet socket.
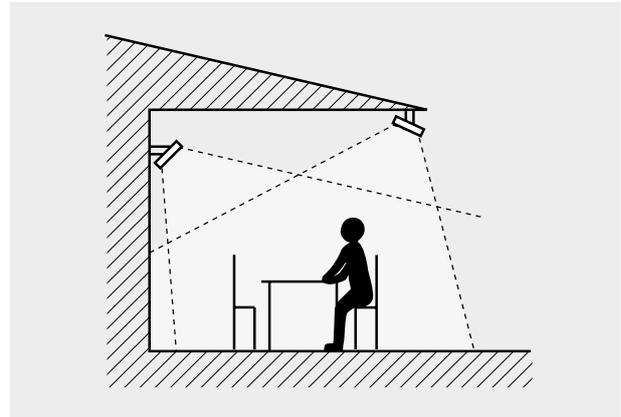
Fig. 1: The heaters should heat from at least two directions for even heating.

Control options

Infrasmart is controlled via an app, the included remote control, or the built-in switch.

Frico Infra app
The Frico Infra app is available for iOS and Android and with a range of 50 m can control up to 8 infrared heaters. Each heater is managed and controlled individually. Stepless heating control (0-100%). Timer function included.

Remote control
Heating in 5 steps. The range is up to 7 m with a free line of sight.

Accessories

KLS1KS

BCSF

BHSS-3

T bracket
Included in Infrasmart IP67

BCDF

L bracket
Included in Infrasmart IP24

MB4040200

KLS1KS, bracket with velcro
Bracket with velcro for quick and flexible mounting under a parasol or an awning. Use with BCSF for infrared heater with T bracket. (Infrasmart IP67).

BHSS-3, floor stand
Floor stand for portable use. Height up to 2.1 m. Use with BCSF for infrared heater with T bracket. (Infrasmart IP67).

BCSF, adapter mounting
Adapter mounting to fix infrared heaters with T bracket on accessories, such as BHSS-3 and KLS1KS.

BCDF, ceiling bracket
Used to secure the infrared heater in the ceiling.

MB4040200, awning bracket
Used to install infrared heaters with T bracket under an awning. (Infrasmart IP67).

Type	Description
KLS1KS	Bracket with velcro
BHSS-3	Floor stand, up to 2.1 m
BCSF9010	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, white
BCSF9005	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, black
BCSF7016	Adapter mounting for KLS1KS and BHSS-3 for infrared heater with T bracket, grey
BCDF209010	Ceiling bracket, 200 mm, white
BCDF209005	Ceiling bracket, 200 mm, black
BCDF207016	Ceiling bracket, 200 mm, grey
MB40402009010	Awning bracket for infrared heater with T bracket, 200 mm, white
MB40402009005	Awning bracket for infrared heater with T bracket, 200 mm, black
MB40402007016	Awning bracket for infrared heater with T bracket, 200 mm, grey

FRICO

Infrapalm

An elegant, portable heating solution

Infrapalm is a stylish and practical freestanding heater for terraces and outdoor restaurants where there are no walls or other mounting possibilities.

Infrapalm has a modern, ergonomic design which makes it easy to position and use.

It includes 2 or 3 infrared heaters providing comfortable heat in several directions.

- Equipped with 2 or 3 infrared heaters, with a total heat output of 3000 - 6000 W.
- Halogen lamp with gold infrared tube and polished aluminium reflector.
- Equipped with a tip guard which switches off the heaters if the post should fall.
- High protection class, IP67.
- Table available as an accessory.
- Casing in powder-coated aluminium. Colours: white RAL9010 or black RAL9005.

Infrapalm (IP67)

Type	Heat output [W]	Voltage [V]	Colour	Max. filament temperature [°C]	Dimensions WxH [mm]	Weight [kg]
IHPA30W	3000 (2x1500)	400V3N~	White	1800	1100x2500-2700	45
IHPA30B	3000 (2x1500)	400V3N~	Black	1800	1100x2500-2700	45
IHPA40W	4000 (2x2000)	400V3N~	White	1800	1100x2500-2700	45
IHPA40B	4000 (2x2000)	400V3N~	Black	1800	1100x2500-2700	45
IHPA60W	6000 (3x2000)	400V3N~	White	1800	1100x2500-2700	45
IHPA60B	6000 (3x2000)	400V3N~	Black	1800	1100x2500-2700	45

Dimensions

Minimum distances
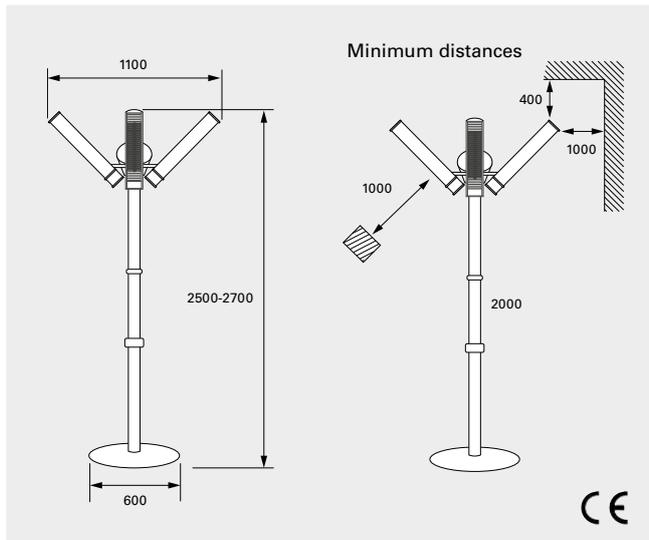
Mounting and connection

Mounting
Infrapalm is a standalone heater which is used when there are no walls or other suspension options. As it is portable, Infrapalm can be placed directly on the floor in areas which need to be heated. Several heaters are required for larger areas. Optimum comfort is achieved if the heat is distributed from at least two directions.

Connection
When installing, connect an extension cord of suitable length to the appliance.

Accessories

IHMC6, central controller with keypad
Central controller which controls 3 x 2 kW. The keypad can control a maximum of 54 kW in total in nine zones or a minimum 3 x 2 kW in 3 zones, in nine steps. 6000W, 400V3~, IP65.

IHMC6S, central controller (slave)
Slave unit without keypad. Central controller which controls 3 x 2 kW. 6000W, 400V3~, IP65.

IHPAT, table
Table for Infrapalm. Made of pressed wood and melamine. Colour: black. Dimensions: 600x600x30 mm.

Type	Description	HxWxD [mm]
IHMC6	Central controller with keypad, 6000 W, 400V3~, IP650	170x280x87
IHMC6S	Central controller (slave), 6000 W, 400V3~, IP65	170x280x87
IHPAT	Table for Infrapalm	30x600x600

Halogen infrared heater ELIR

For outdoor applications where a high flexibility is desired

ELIR gives an intense heat suitable for all outdoor applications. While ELIR is light, stable and portable it is well suited for temporary heating at construction sites and events. High protection class (IP65) makes it possible to use the heater in almost any environment. With its concentrated heat ELIR is a good complement to dehumidifiers for drying in areas damaged by water.

ELIR has a thorough design in a compact format. Simple, robust and light (1 kg). ELIR has no protective glass which means 10–15 % higher efficiency compared to a heater with glass with the same protection class.

- All parts are anti-corrosive.
- Wall bracket included. Stand and chains for ceiling installation are available as accessories.
- Casing/reflectors of high-gloss polished aluminium with maximum resistance against corrosion.
- Grey terminal boxes of heat and weather resistant plastic. Colour: RAL 7035.

Halogen infrared heater ELIR (IP65)

Type	Heat output	Voltage	Amperage	Max. lamp temperature	Dimensions LxHxW	Weight
	[W]	[V]	[A]	[°C]	[mm]	[kg]
ELIR12	1200	230V~	5,2	2200	712x112x83	1,0

Installation height
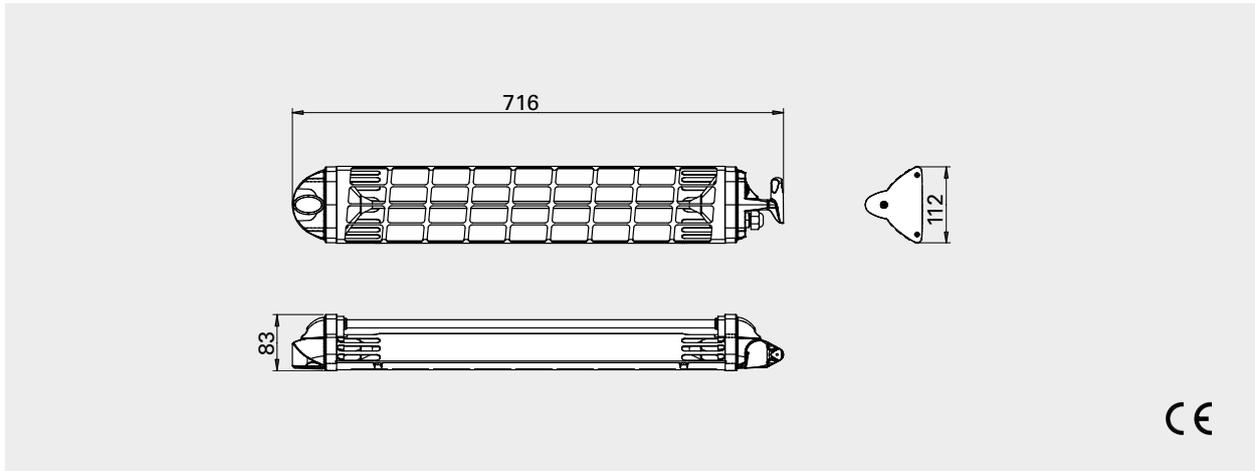
2–3 m

2 m

Design and specifications are subject to change without notice.

2018-06-15

Dimensions

716

112

83

CE

Minimum distances

400

600   600   600

1000

1800

Flammable material

600

400

600

1000

1800   Flammable material
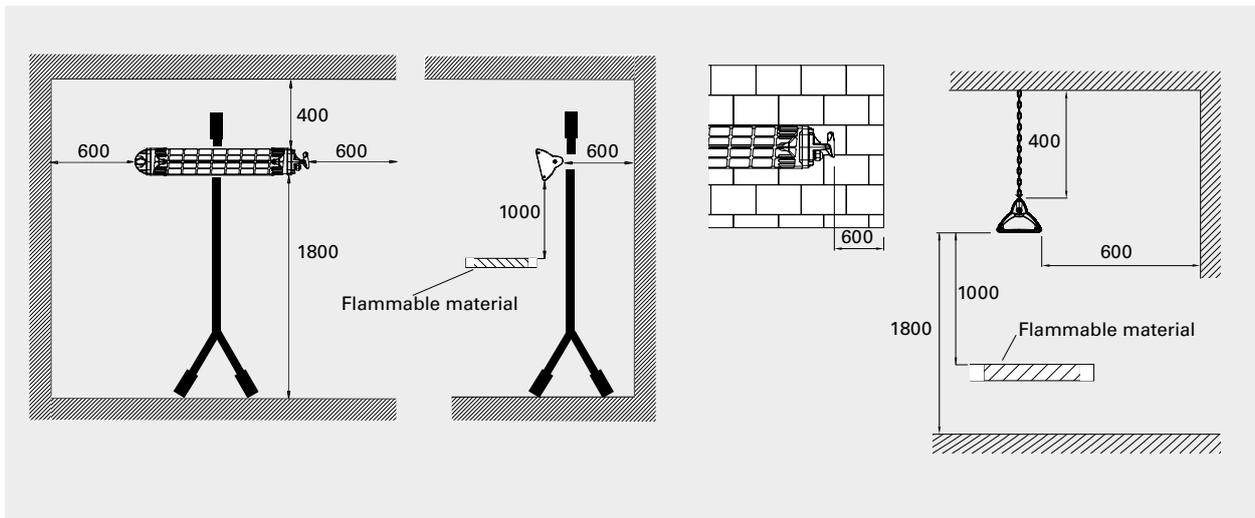
ELIR is installed horizontally on a stand, on a wall or suspended by chains.

High protection class (IP65) makes it possible to install the heater in almost any environment.

Halogen infrared heater ELIR

Positioning, mounting and connection

Positioning
The heaters must be placed so that they cover the area to be heated, see fig. 1. The normal mounting height is 2–3 metres above the ground/floor. A rule of thumb for infrared heaters is that 600–800 W/m² increases the experienced temperature by about 10 °C. The output demand can be reduced if the area to be heated is protected. If the area only has a roof, at least 800 W/m² should be installed. 600 W/m² is sufficient if the area has three walls. For enclosed areas, the output demand must be calculated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Mounting
ELIR is installed horizontally on a stand, on a wall or suspended by chains. The angle of the heater can be adjusted for optimum comfort. Wall bracket included. Stand and chains for ceiling installation are available as accessories.

Connection
ELIR is intended for both portable use and permanent installation. Cable and plug are included in delivery.
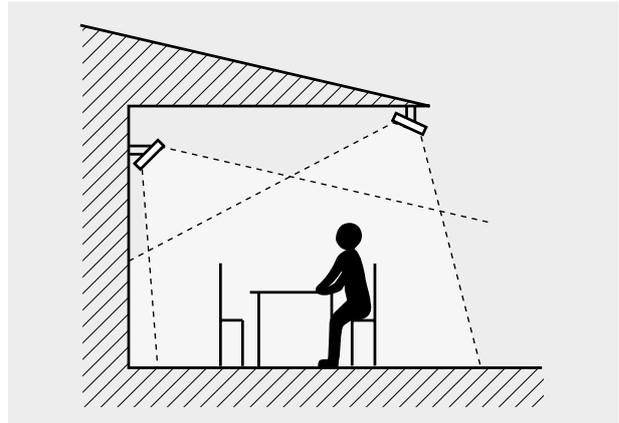
Fig. 1: The heaters should heat from at least two directions for even heating.
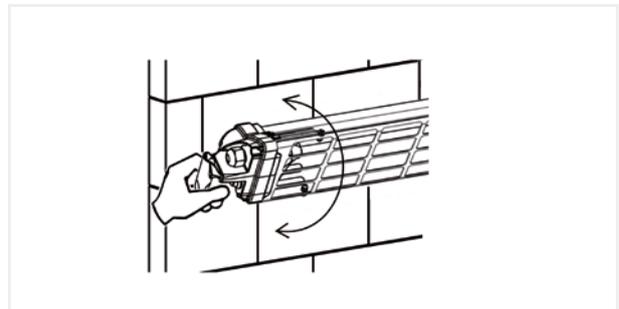
Adjusting angle

ELIR is compact and light. Mounted on a stand ELIR is portable and is well suited for temporary heating.

With its concentrated heat ELIR is a good complement to dehumidifiers for drying in areas damaged by water.

Control options

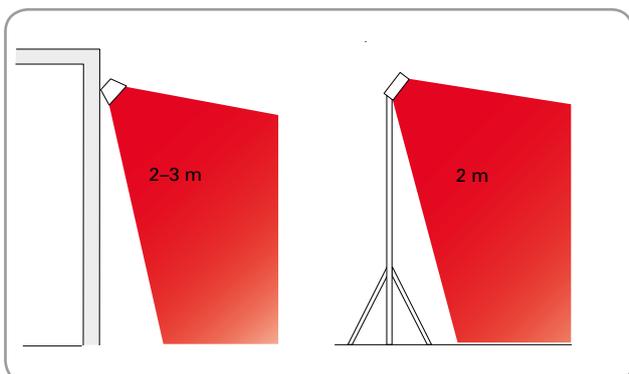### Timer control
The timer can be set to a desired time. If the current load exceeds the timer's setting range or if you want to control a larger system, a contactor can be used.

• CBT, electronic timer

For further information and options, see the "Controls" section.

Accessories

ELIRC, chain for ceiling mounting

ELIRSTP, floor stand for portable use
Floor stand (tripod) with bracket for ELIR included.

IREL12, extra lamp
The halogen lamp of 1,2 kW is replaceable. The life of the lamp will depend among other things on surrounding temperature and positioning.
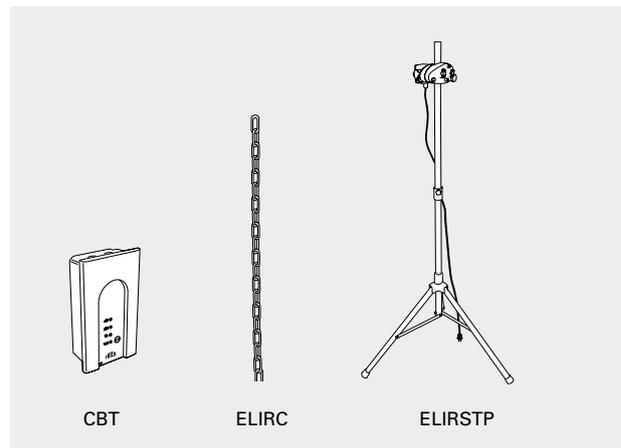
CBT   ELIRC   ELIRSTP

Type	Description	HxWxD [mm]
CBT	Electronic timer	155x87x43
ELIRC	Chain for ceiling mounting	L: 2500
ELIRSTP	Floor stand for portable use	H: 2000
IREL12	Extra lamp	

The control system is the intelligent centre and the "brain" of a heating system and essential for good comfort level and low energy consumption. The temperature of an electric heating system can be quickly, easily and precisely regulated and is more responsive than any other heating system.

IHBD3

Comfort controller IHBD3

For wireless control of infrared heaters

IHBD3 is a comfort controller for all types of infrared heaters, whatever the brand.

The comfort controller allows you to wirelessly control one or more infrared heaters via an app (iOS or Android) or by using the remote control supplied. The IHBD3 also allows manual control.

- App, remote control and manual control.
- Stepless control via the Frico Infra app.
- Remote control included, for regulation in 5 steps.
- Heating effect up to 3000 W.
- High protection class, IP65.
- Aluminium housing.

Frico Infra app

The Frico Infra app is available for Android and iOS and has a range of 50 m, even without a free line of sight.

The app can control up to 8 IHBD3 units, which in turn can each control one or more infrared heaters. Each comfort controller is managed and controlled individually. Stepless heating control (0-100%). Timer function included.

Remote control

The remote control can be used to control one or more IHBD3 units, which in turn can each control one or more infrared heaters. Heating in 5 steps. The range is up to 7 m with a free line of sight.

Manual control

You can also manually control the heaters in 3 steps directly from the comfort control unit.

Comfort controller IHBD3 (IP65)

Type	Voltage	Max. breaking current	Dimensions HxWxD	Weight
	[V]	[A]	[mm]	[kg]
IHBD3	230V~	13	88x118x48	0,9

Controls

Thermostats

TAP16R | T10S | TK10S | TKS16(400) | TD10 | RTI2 | RTI2V | KRT1900/1 KRT2800 | KRTV19 | TBK10 | TBKS10

TAP16R, electronic thermostat
Programmable thermostat for room/floor heating.
Processor controlled with digital display and built-in clock. A number of weekly preset programs simplify programming. Several advanced features are included such as adaptive function, open window mode, energy saving and frost protection programs.
Setting range: +5 - +37 °C. 230V. Max. breaking current: 16A. IP21.

T, TK, TD, basic offer thermostats
Processor controlled thermostats for room/floor heating. Available with concealed/visible knob or digital display. Model with visible knob also available with switch and in 400 V.

On/off control (for slow systems) or proportional control (for faster systems) in the same thermostat. TD10 has adjustable P-band and time of cycle.

Internal and/or external sensors (external sensor RTS01 available as an accessory) give the possibility of selecting the sensor function e.g limiting external sensors (min/max). Save reduction either by built-in manual switch or via external timer. CE compliant.

RTI2, electronic 2-step thermostats
Processor controlled 2-step thermostats for room heating /cooling. Available with concealed or visible knob. Adjustable temperature difference between the steps (1–10 degrees). Save reduction via external connection timer (1–10 degrees). External sensor (RTS01) available as an accessory.
High protection class (IP44). CE compliant.

KRT, capillary tube thermostats
Capillary tube thermostats for room heating/cooling. Available with concealed and visible knob, and control in 1 or 2 steps. KRT2800 controls in 2 steps and has adjustable temperature difference between the steps (1–4 degrees). KRT1901 has a temperature range of -35–+10 °C. High protection class (IP44 resp. IP55). CE compliant.

TBK, bimetal thermostats
Mechanical bimetal thermostats with acceleration resistance for room heating/cooling. TBKS10 also has a 1-pole switch. CE compliant.

Technical specifications

Type	Voltage (supply)	Max input	Setting range	Limit floor heating	Save reduction	Proportional control*	Static differential	Protection class	Dimensions HxWxD
	[V]	[A]	[°C]	[°C]	[K]	[K/min]	[K]		[mm]
TAP16R	230V~	16	5–37	5-45	Adjustable	-	0,3	IP21	87x87x52
T10S	230V~	10	5–30	10–40	-4	2K/10min	0,5	IP30	80x80x31
TK10S	230V~	10	5–30	10–40	-4	2K/10min	0,5	IP30	80x80x31
TKS16	230V~	16	5–30	10–40	-4	2K/10min	0,5	IP30	80x80x39
TKS16400	400V2~	16	5–30	10–40	-4	2K/10min	0,5	IP30	80x80x39
TD10	230V~	10	5–37	5–37	Adjustable	Adjustable	0,3	IP30	80x80x31
RTI2	230V~	16/10, 230/400V~	5–35	-	Adjustable	-	0,5	IP44	155x87x43
RTI2V	230V~	16/10, 230/400V~	5–35	-	Adjustable	-	0,5	IP44	155x87x43
KRT1900	-	16/10, 230/400V~	0–40	-	-	-	1,0	IP55	165x57x60
KRT1901	-	16/10, 230/400V~	-35–+10	-	-	-	1,0	IP55	165x57x60
KRTV19	-	16/10, 230/400V~	0–40	-	-	-	1,0	IP44	165x57x60
KRT2800	-	16/10, 230/400V~	0–40	-	-	-	1,0	IP55	165x57x60
TBK10	230V~	10	5–30	-	-	-	0,5	IP30	85x82x39
TBKS10	230V~	10	5–30	-	-	-	0,5	IP30	80x80x43

*) P-band [K]/time of cycle [min]

Functions

	Programmable	Basic offer				Electronic 2-step		Capillary tube			Bimetallic	
	TAP16R	T10S	TK10S	TKS16(400)	TD10	RTI2	RTI2V	KRT1900/1901	KRTV19	KRT2800	TBK10	TBKS10
Adaptive	X											
Open window mode	X											
Internal sensor	X	X	X	X	X	X	X	X	X	X	X	X
External sensor	X*4	X*1	X*1	X*1	X*1	X*1	X*1					
Save reduction		X*2	X*2	X*2	X*2	X*2	X*2					
1-pole switch	X			X								X
Volt free contact		X	X	X	X	X	X	X	X	X		
Contact, 1-pole closing	X	X	X		X							
Contact, 1-pole alternating				X		X		X	X	X	X	X
Digital display	X				X							
Advanced extra functions*3	X				X							
Internal setting		X				X		X		X		
Processor controlled	X	X	X	X	X	X	X					
Bimetallic											X	X
Capillary tube								X	X	X		
Fits wall box system	X	X	X	X	X						X	X
Heating or cooling function		X	X	X	X	X	X	X	X	X	X	X
2-step						X	X			X		
Adjustable temp.diff. between the steps						X	X			X		

*1) External sensor (RTS01) as accessory.
*2) Can be used with an external timer.
*3) See manuals on www.frico.se.
*4) External sensor (RTX54) as accessory, cable max. 50 m.

Accessories

TAP16R +TEP44   RTX54

SKG30   RTS01

TEP44, protective enclosure for TAP16R
Enclosure which is required should TAP16R be used in environments which demand IP44 and used in conjunction with external room temperature sensor (RTX54) which replaces the internal sensor.

RTX54, external room temperature sensor
Replaces internal sensor when using TEP44. Can also be used to achieve an improved detection point in the room when locating the control unit in order that the internal room temperature sensor does not show a relevant value. Cable lenght: max. 50 m. NTC10KΩ. IP54.

SKG30, black bulb sensor
Measures air and radiation temperature. High-quality thermistor. NTC10KΩ. IP30.

RTS01, external room temperature sensor
External sensor with 3 m cable. NTC10KΩ.

Type	Description	HxWxD [mm]
TEP44	Protective enclosure for TAP16R, IP44. Must be supplemented with RTX54.	87x87x55
RTX54	External room temperature sensor. Replaces internal senor. NTC10KΩ, IP54	82x88x25
SKG30	Black bulb sensor, NTC10KΩ, IP30	115x85x40
RTS01	External room temperature sensor, NTC10KΩ	

Controls

Other controls

CIRT

ERP

CIRT, stepless output control with timer

Stepless output control with timer, primarily intended for infrared heaters and other radiant heaters. Intended for single phase (3600W/230V~) or two phase (6000W/400V2~) electric heaters. Especially suited for spot amd zone heating. The heat contribution is regulated for best comfort (25-100 %). The built-in timer can be set for 0.5 to 4 or 4 to 24 hours. High protection class. IP44.

ERP, electric heating control

Stepless pulse control intended for single phase (3600W/230V) or two phase (6000W/400V2~) electric heaters. Cannot control 3 phase loads. Pulse time 60 secs. Triac control (quiet control). Integrated temperature sensor. External sensors available as an accessory. Save reduction function via external connection timer (1–10 degrees). For larger power outputs a slave unit (ERPS) can be connected. Each ERPS can handle the same power as ERP. IP20.

Type	Voltage [V]	Max input [A]	HxWxD [mm]
CIRT	230/400V2~	16	155x87x43

Type	Voltage [V]	Max input [A]	HxWxD [mm]
ERP	230/400V~	16	153x93x40
ERPS	230/400V~	16	153x93x40

Accessories ERP

Type	Description
ERPRG	Room sensor ERP
ERPGG	Floor/duct sensor ERP

Other controls

PDK65   PDK65S

PDK65, presence detector with power supply
Complete system including simple installation, for presence control in smaller rooms. Consists of a presence detector, power supply and 3 m cable. The presence detector (IP42) is a passive IR detector which is connected via a low voltage cable and placed in the best location for detection. The power supply (IP65) can power up to 5 detectors. External potential-free contacts can be connected. 230V~, max 2.3 kW. Max. start current: 288 A.

PDK65S, additional presence detector to PDK65
Up to 5 detectors can be connected to the same power supply with the PDK65. The passive IR detectors can be connected using low voltage cable and placed in the best location for detection. IP42.

Type	Voltage [V]	Max input [A]	HxWxD [mm]
PDK65	230V~	10	102x70x50 88x88x39
PDK65S	230V~	10	102x70x50

RB3   RB123

RB3, relaybox 400V3N~
Relay box which is required in order to enable controlling 230V3~/400V2~/400V3N ~ units with TAP16R. Max. breaking current: 16A. IP44.

RB123, relaybox with 3 step output control
Relay box which is required in order to enable controlling 230V3~/400V2~/400V3N ~ units with TAP16R. 3 step output control and on/off. Max. breaking current: 16A. IP44.

Type	Voltage [V]	Max input [A]	HxWxD [mm]
RB3	400V3~	16	155x87x43
RB123	400V3~	16	155x87x43

S123

S123, manual switch for 1-2-3 steps
Controls the output in three steps 0-1/3-2/3-3/3. IP44.

Type	Voltage [V]	Max input [A]	HxWxD [mm]
S123	230/400V3~	20	72x64x46

CBT

CBT, electronic timer
Electronic timer with alternating contact. Setting range 1/2-1-2-4 or 4-8-16-24 hours respectively. The setting range can be limited down to a maximum time of 1/2 hours. IP44.

Type	Voltage [V]	Max input [A]	HxWxD [mm]
CBT	230V~	16	155x87x43

Controls

Just a click away

We simplify everyday life by giving you relevant product information together with our knowledge within heating. At www.frico.se you will always find updated information, you can receive help to select the correct product and get inspiration from among our references, see our news, manuals, wiring diagram etc.
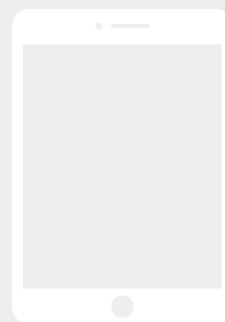
Technical handbook Radiant heaters

Heating - Energy

The need to heat a building depends on the temperature difference between the room air and outdoor air.

Energy losses in a building can be divided into two parts:

- Transmission losses: losses via building structures (roof, walls, etc.).
- Ventilation losses: losses through ventilation, leakage and openings.

The temperature of the outdoor air varies with the seasons and location, while the temperature of the rooms air should be maintained at a balanced and comfortable level.

The energy requirement for a building is the energy consumed during a year, i.e. the coloured area in the diagram below.

The design output requirement for a building is the output required to maintain the required room temperature when it is cold outside.
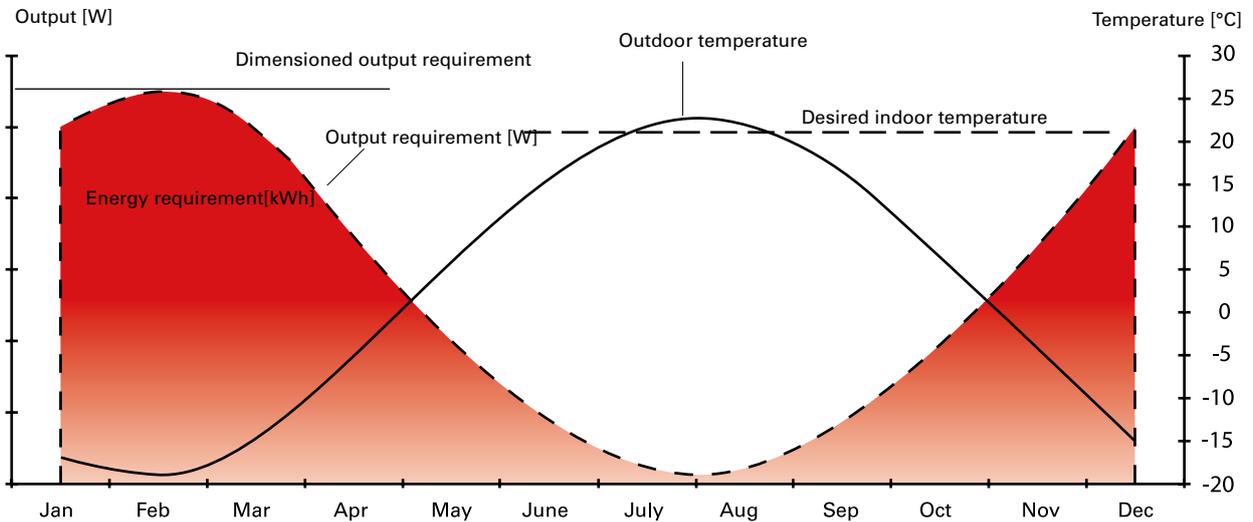
Duration diagram

A common method of illustrating the energy requirement for heating is to use a Duration diagram. The Duration diagram has two axes. The X axis shows the number of hours in one year, the Y axis the outdoor temperature in °C. One can draw a curve to describe the duration of the outdoor temperature in each place. If the average temperature for the year, is +8 °C, then it is colder than +8 °C for six months or 4380 hours.
If a line for desired indoor air temperature is inserted into the diagram, e.g. 20 °C, this line will intersect with

the duration diagram to show the number of degree hours that are needed for heating to 20 °C. The number of degree hours is a measurement that is proportional to the energy requirement for heating. For any particular place, one can either calculate based on such a diagram or consult climate tables, later on in the chapter.
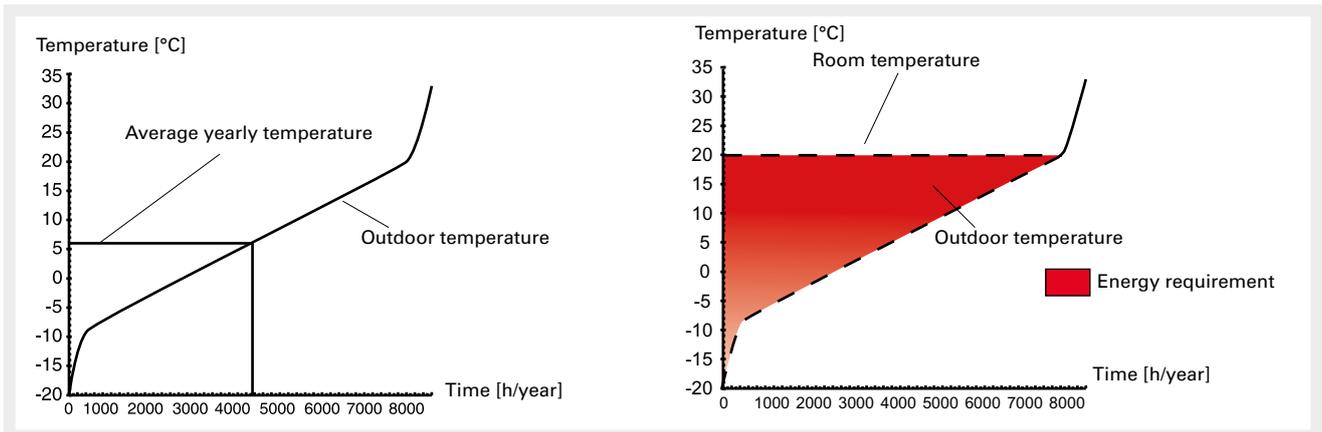
Heating systems

The heating system must cover all energy losses, both from transmission and ventilation.

Three main types of heating systems are:

• Radiant heating

• Air heating

• Convective heating, i.e. radiators and convectors

Radiant heating

Radiant heating transfers heat to surfaces and objects without warming the air on the way. Surfaces are heated and then in turn heat the air within the room. People experience the direct contribution of radiant heat as warmth. The room feels comfortably heated even if the air temperature is relatively low. Radiant heating also prevents overheated air gathering under the ceiling. The equalized distribution of temperature vertically as well as the somewhat lower air temperature contributes to large energy savings.

Radiant heat effectively counteracts cold radiation and cold draughts from large windows, for example.

Air heating

Heating with warm air covers transmission and ventilation losses by supplying heated air to the building. The warm air cools along the outer walls, due to transmission losses. Therefore, the supply air temperature must be higher than the desired room temperature.

Because the heated air is lighter and rises in the room, large temperature differences between the ceiling and the floor can occur. At times, it may be necessary to equalize the differences with e.g. ceiling fans.

Convective heating

Convective heating transfers heat to the room by warming the air as it passes hot surfaces, radiators, or convectors. The air flow past the radiator or convector is maintained by thermal currents. The warmed air rises and is replaced by colder air. Rotation, or convection, of the air occurs.

Cold draughts from e.g. windows are effectively counteracted by the rising stream of warm air if the heat source is placed under the window.

Energy savings

Heat losses
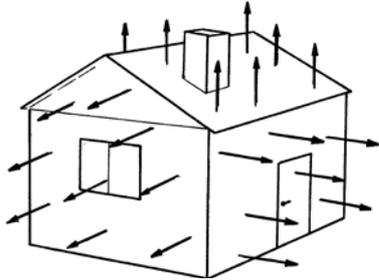
Transmission losses
The size of transmission losses varies according to the areas of the building parts and insulation. The losses are proportional to the temperature differences between indoor air and outdoor air.
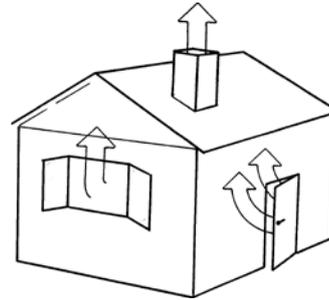
Ventilation losses
The ventilation in a building is either mechanical or of the natural type. Mechanical ventilation most often consists of a supply and exhaust air unit that makes heat reclamation possible. Natural and involuntary ventilation consists of thermal currents causing warm air to rise and leak through openings and unsealed areas.

Methods to reduce heat losses and heat costs

Improved insulation of a building naturally reduces heat losses and increases energy savings, but there are other methods of reducing heating costs as well.

Equalizing temperature differences
Warm air is lighter than cold air and is gathered in the highest spot inside a building. Vertical temperature differences between floor and ceiling occur. The temperature gradient (°C/m) is a standard of the temperature rise per metre of height and varies depending on the heating system and the season. In rooms with high ceilings, the temperature difference between the dwelling zone and the ceiling is often very big, between 10-15 °C. Equalizing the temperature differences can reduce heat losses by as much as 30 % while making optimal use of the heat.

Radiant Heaters
Heating with a ceiling mounted radiant heater is indirect. The heat develops when heat rays meet surfaces such as floors, walls, machines, etc. The surfaces then heat the air in the dwelling zone. The temperature difference between ceiling and floor thus becomes very small.

Ceiling Fans
Heating with e.g. fan heaters or radiators gives relatively high temperature gradients. The installation of ceiling fans is a very simple and inexpensive way to equalize the temperature difference. The heated air is pushed down from the ceiling to the dwelling zone.
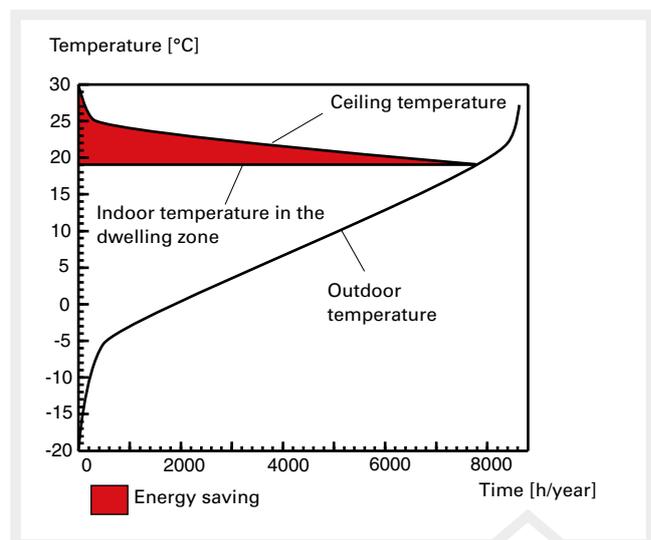
Lower indoor temperature
Another method of saving energy is to lower the indoor temperature. However, this must be done without sacrificing the comfort.
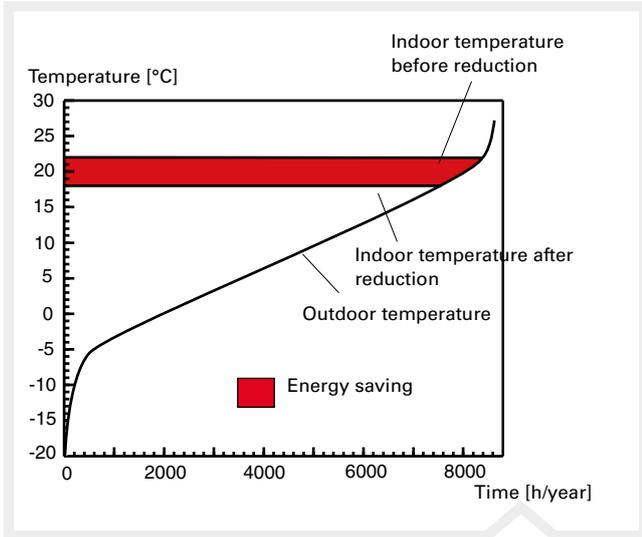
• **Lower air temperatures**
Using radiant heaters, the air temperature in a room can be lowered by a few degrees while still maintaining an experienced high temperature, the so-called operative temperature. A reduction of the temperature by 1 °C results in energy savings of around 5 %. Operative temperatures are those temperatures which human beings feel. They are the sum of the air temperature and radiation temperatures. All objects provide radiant temperature changes. Cold surfaces cause a subtraction and warm surfaces an addition. Operative temperatures can be described thus:

$$t_{op} = \frac{t_{air} + t_{rad.}}{2} = \frac{t_{air} + (t_{air} + \Delta t_{rad.})}{2} = t_{air} + \frac{\Delta t_{rad.}}{2}$$

where t_{air} = air temperature
$t_{rad.}$ = radiant temperature (incl. air temperature)
$\Delta t_{rad.}$ = radiant temperture change (excl. air temperature)

• **Zone and spot heating**
With radiant heaters, different zones of a building may have varying temperatures. The entire building does not have to have the same high temperature if for example work stations are far apart. Even the comfort aspect means that different work situations require different temperatures. Spot heating can be regarded in the same way as spotlighting. When someone is there, the heating or lighting is increased.

• **Low temperature gradient**
Heating with radiant heaters provides a highly equalized vertical temperature distribution. The heat develops when the rays meet surfaces such as floors, walls, machines, etc. The surfaces in turn heat the air in the dwelling zone. The temperature differences between the ceiling and the floor become very small and "overheating" minimal. Especially in buildings with high ceilings, great energy savings are obtained compared to conventional heating systems.

The temperature gradient [°C/m], the temperature rise per metre of height, is very low for radiant heaters, approx. 0.3 °C/m. Warm air heating or heating with conventional radiators causes significantly greater temperature differences per metre of height with temperature gradients of 2.5 and 1.7 °C/m respectively, at full output.
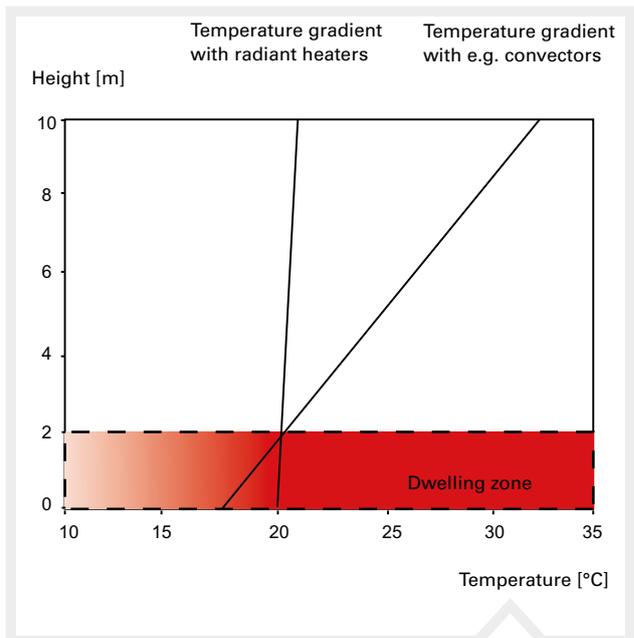
• **Time control**
When there is no-one in the building, e.g. at night and on holidays, the temperature can be lowered.

Reduce leakage

Tremendous energy losses often occur through openings such as doors and gates. Expensive heated or cooled (air-conditioned) air disappears through the opening. This can be prevented by the installation of air curtains. Air curtains create a separation between different temperature zones. Balanced ventilation and shorter opening times also contribute to the reduction of energy leakage. Read more about Frico air curtains on our website.

Greater equalization of temperatures

A standard on/off thermostat can be used to vary the temperature around a set value. If the desired temperature should never be lower than 20 °C, the average temperature is approximately 22 °C. With a triac-controlled output regulator, the room temperature can be set to 20 °C and the temperature won't deviate from the setting. Lowering the temperature by 1 °C gives energy savings of 5 %.

Heat reclamation

To reduce ventilation losses when ventilation is mechanical, a portion of the energy content of the exhausted air can be reclaimed. One simple method is to immediately recycle portions of the warm exhaust air to the supply air unit, so-called return air. Another way is to use a heat exchanger that takes in and returns portions of the heating energy to the building.

Temperature [°C]

Energy saving

Time

Temperature [°C]

Room temperature

Supply air temp. after heat reclamation

Outdoor temperature

Energy saving

Time [h/year]
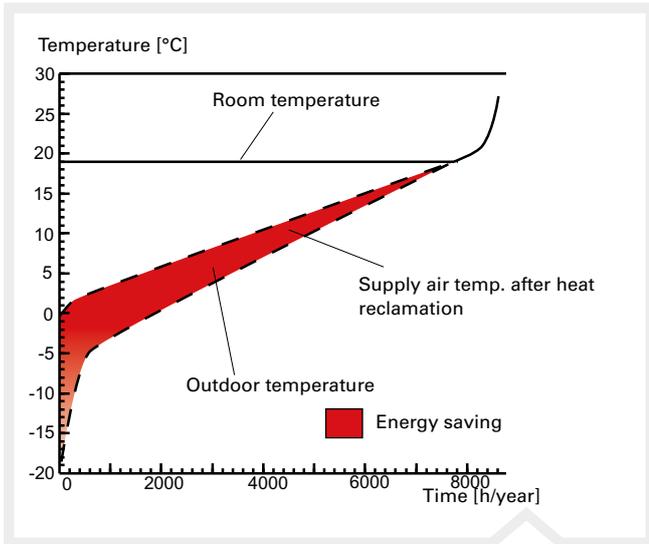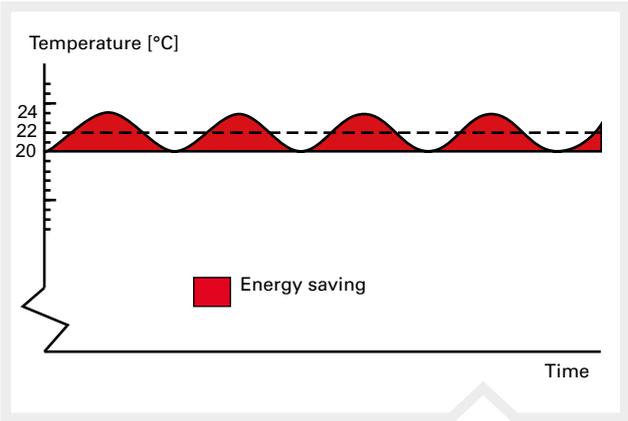
What is radiant heating?

Temperature radiation arises because all bodies emit energy in the form of electromagnetic radiation. Because the radiation comes from a warm body, it is called heat radiation. The figure below shows where temperature radiation is found in the electromagnetic spectrum. Wavelength and radiation intensity from radiant heaters are temperature dependent. The higher the element temperature of the radiant heater, the shorter the wavelength and the higher the radiation intensity.

Two bodies only exchange radiation if there is a temperature difference between them. Human beings constantly exchange heat with their environment. When you loose a lot of heat you are cold. It is necessary to reach a thermal point where there is balance, this point corresponds with the so called comfort temperature. The comfort temperature is defined by the air temperature, wall temperature, air speed and atmospheric humidity. Heating with radiant heating is perfect to maintain a good comfort.

0,76	2	3	4 μm		1 mm
Shortwave IR	Middle-wave IR		Long-wave IR		

Radiation	Ultraviolet radiation	Vis. light	Infrared radiation	Radio waves
1 nm		1 μm	1 mm	1 m
10^{-9}		10^{-6}	10^{-3}	10^{0}

Electromagnetic spectrum
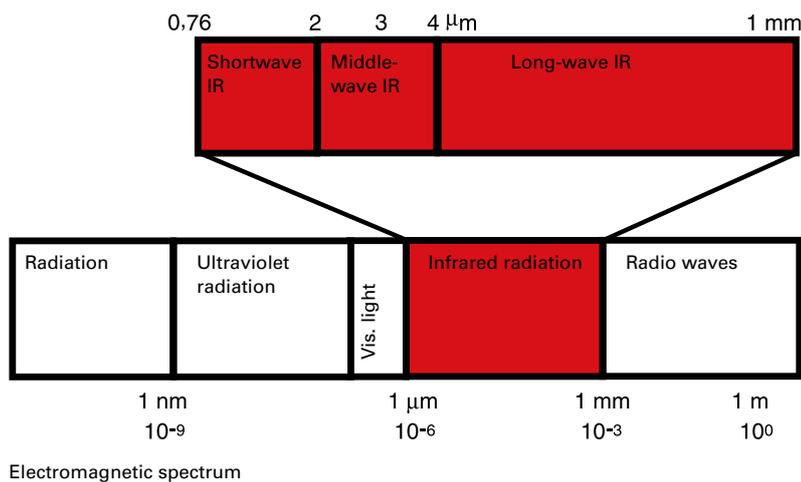
Examples of usage of various radiant heaters

Warehouse with high ceiling: Elztrip EZ300 or Industrial infrared heater IR

Loading bay: Industrial infrared heater IR

Shop: Elztrip EZ100

Cashier: Thermocassette HP
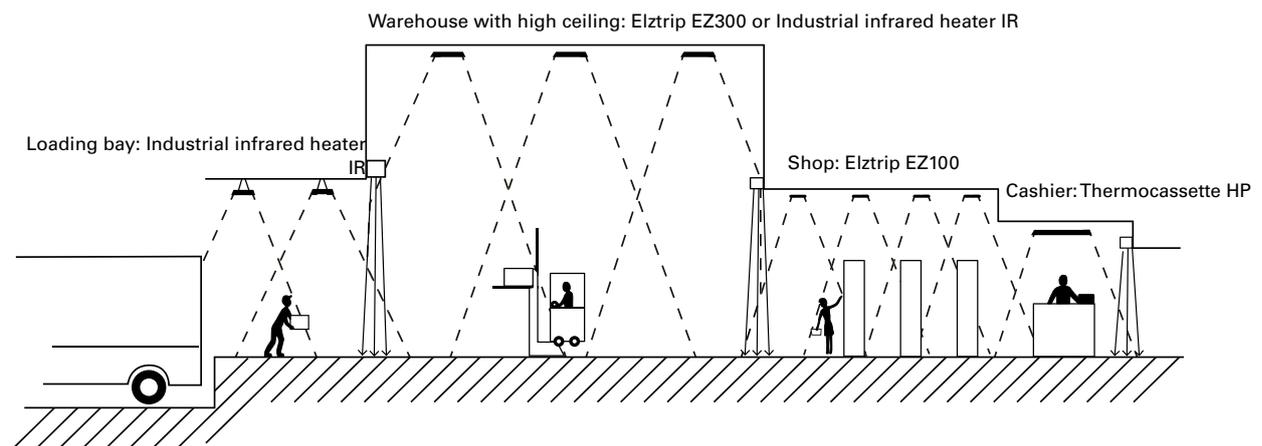
Guidance – radiant heating indoors

Total heating

The output requirements of a building must be calculated when designing a heating system. Read about Output and energy calculations on the following pages. For radiant heaters with a lower element temperature (e.g. Thermocassette HP and Elztrip) there is a rule of thumb to estimate approximately how many radiant heaters are required to heat a building:

$$\text{Min. number of heaters} = \frac{\text{Area of the premises [m}^2\text{]}}{\text{Installation heigth [m] × Installation heigth [m]}}$$

This formula is a basic estimation of the minimum number of radiant heaters needed to maintain the comfort. To calculate the right output for each heater, the total heating requirement must be calculated.

Recommended distance for Elztrip

When planning an installation, the distance between the heaters should not be greater than the height between heater and floor, that means (a) should be less than (H). See pictures. In rooms not often used, the comfort demands are usually lower and the distance between the heaters can be increased. In rooms frequently used, the distance between a sedentary person and heater should be at least between 1.5 to 2 metres (Δh). When these two guide lines are followed, the difference in operative temperature will not exceed the comfort level Δtop= 5 °C. This means that the difference between the real temperature and the temperature that we sense, will not be more than 5 °C.

Zone heating

Different work situations require different temperatures. With radiant heaters such as Elztrip, it is simple to divide the building into temperature zones or to spot heat individual work stations. This results in lower heating costs and better heating comfort.

Complementary heating

As addition to other heating systems and when expanding an existing system, radiant heaters are often a simple, inexpensive solution. For a water heated building, putting up a single or a few electrical heaters is often a smoother and more flexible solution than extending the water pipe system.
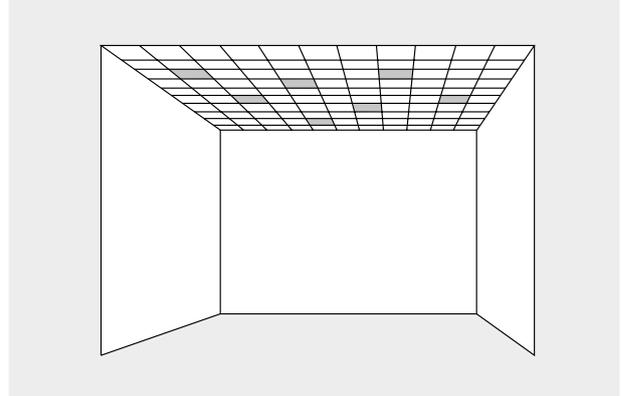
Example of the total heating with Thermocassette HP installed in a suspended ceiling.
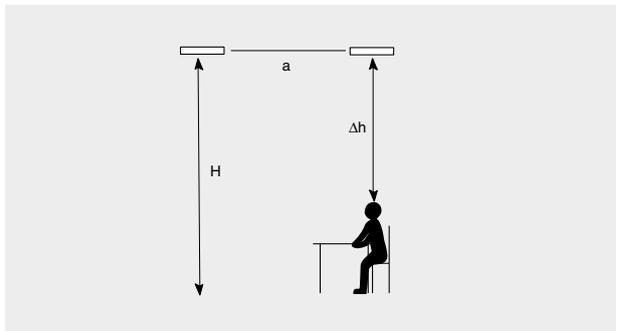
Recommended distance for Elztrip
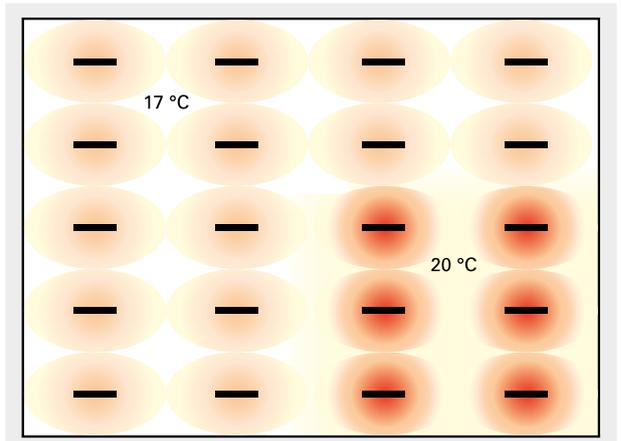
Plan sketch: Temperature zones with radiant heaters.

Suitable radiant heaters for zone heating are Thermocassette HP, Elztrip, IR and Aquaztrip, depending on the installation height and the condition of the building.

Further enhances energy efficiency

Heating with radiant heaters is very energy efficient, however there are even greater possibilities for energy savings while maintaining comfort. Improved results can be achieved by supplementing with a black bulb sensor (which measures the operative temperature) or presence detector (which ensures that the heater is only used when necessary).

Black bulb sensor

The addition of radiant heating's direct heat means that the air temperature in the building can be slightly lowered by a few degrees without affecting the level of comfort. Read about perceived, operative temperature on the previous pages.

A black bulb sensor which measures the perceived combination of air and radiant temperature is connected to the thermostat in order to fully utilise this output. When it is at its coldest, the radiant addition will be at its greatest resulting in the largest saving thanks to the black bulb sensor. Lowering of the air temperature by 1 °C gives an energy saving of approx. 5 %.

Presence detector

A radiant heater starts to heat immediately once it is switched on, which is ideal when used in combination with a presence detector. Thus, the radiant heater is only used when necessary, which ensures energy saving.

Cold draught protection

A cool surface such as a window has a chilling effect on the neighbouring air. Radiant heaters provide efficient and economical protection against cold draughts caused by windows by heating the window's surface. The colder the window, the more radiant heat it will draw. The radiated heat "automatically" migrates to where it is most needed, which facilitates the creation of a comfortable indoor climate.
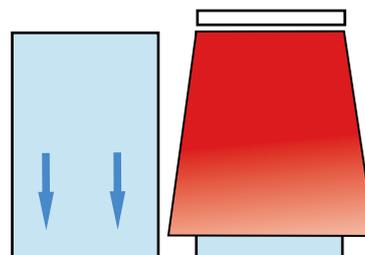
Suitable radiant heaters for draught protection are Thermoplus, Thermocassette HP, Elztrip and Industriinfra IR, depending on the installation height and window area.

Guidance – radiant heating outdoors

Positioning
The heaters must be placed so that they cover the area to be heated. Optimum comfort is achieved if the heat is distributed from at least two directions.

Output requirement
A rule of thumb for the output requirement can be used to estimate how many and which radiant heaters are required. The output demand can be reduced if the area to be heated is protected. For enclosed areas, the output demand must be calculated.

Should it be very windy, a higher output heater would be required to ensure adequate heating. The same applies to installation height; should the heaters be installed relatively high, a higher output would be required.

Infrared heater with tubular elements
750–1000 W/m² raises the perceived temperature by approx. 10 °C.
If the area only has a roof: at least 1000 W/m².
If the area has three walls: 750 W/m².

Halogen and carbon infrared heaters
600–800 W/m² raises the perceived temperature by approx. 10 °C.
If the area only has a roof: at least 800 W/m².
If the area has three walls: 600 W/m².

Installation height
Should the heater be mounted at a raised height, distribution should be directed in such a way that it can be felt all the way down to the seating area. However, should the heater have a low placement, directed radiant heat can be perceived as uncomfortable and a radiant heater with wide distribution would be more suitable.
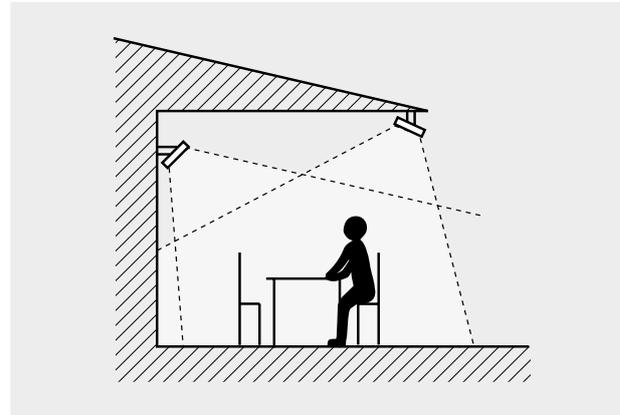
The heaters should heat from at least two directions for even heating.
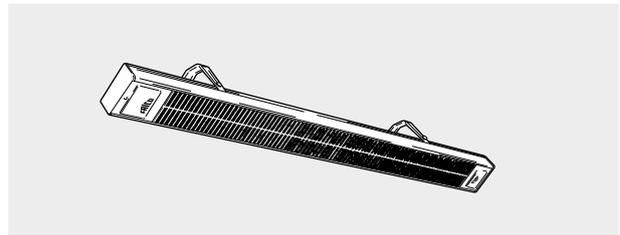
CIR is an example of an infrared heater with tubular elements.
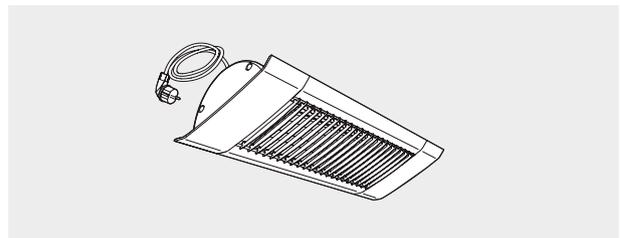
Halogen infrared heater IH and Carbon infrared heater IHC have the same appearance, but with different lamps and heat distribution.

Problem solutions for outdoors
Radiant heaters are not only used for pavement cafés and terraces, they can also be used as a solution for numerous outdoor heating problems.

Heating sedentary spectators in a sports stand is something that radiant heaters can do well.

Problems with ice formation on e.g. loading bays can be easily solved with an infrared heater for outdoor use which is mounted on an outer wall.

Temporary heating is often required for outdoor customer events. A radiant heater on a portable stand which can be moved around as required is a practical solution.
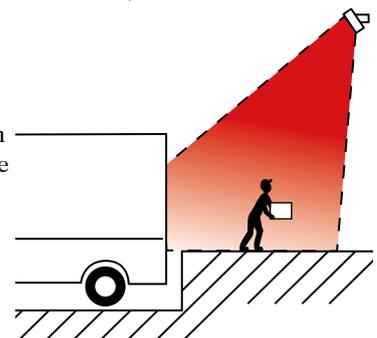
Comparison between electric infrared heaters and gas heaters (LPG)

An alternative to an electric infrared heater is a terrace heater using LP gas. A
gas heater requires no electrical connection, which at times can be practical,
yet there are more advantages of electric infrared heaters.

Advantages of an electric infrared heater:

- Energy efficient - nearly all additional energy is converted to heating
- Safe to use
- Copes better with weather and wind
- Requires a minimum of maintenance
- Heats immediately as soon as you press the on button
- Can also be used in smaller areas where oxygen supply is limited
- Better for the environment
- Space effective
- Low operating costs
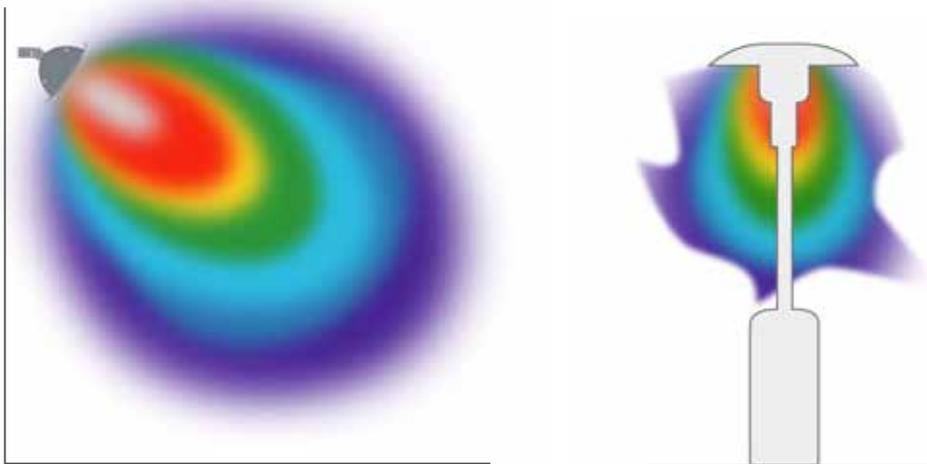
The comparison between Frico's infrared heater IHW and a gas heater (LPG) indicates that the gas heater
does not last as long and delivers a variable result.

Calculation example - operating costs

Area: 15 m²
Used 8 hours/day
Used 100 days/year

Infrared heater IHW10 (2 pcs)		Gas heater (LPG)	
		Gas cylinder 11 kg	20€
Electricity rate (European average)	0,2€/kWh	Gas consumption	1 kg/h
Operating cost per hour	0,4 €	Operating cost per hour	1,8 €
Operating cost per day	3,2 €	Operating cost per day	14,4 €
Operating cost per year	320 €	Operating cost per year	1440 €

Output and energy calculation

Output requirements

Heat losses from a building consist of two parts. Transmission losses through walls, floors, windows, doors and the roof, and ventilation losses.

Transmission losses:
$$P_T = A \times U \times (t_{room} - DUT)$$

Ventilation losses:
$$P_v = q \times c \times \rho \times (t_{room} - DUT)$$
or
$$P_v = Q \times (1 - \alpha) \times (t_{room} - DUT) \times 0.33$$

where

U	= thermal transmittance value [W/m² °C] (=K-value)
A	= area of enclosed surfaces [m²]
t_{room}	= room temperature [°C]
DUT	= lowest dimensioned outdoor temperature of the district [°C]
q	= calculated outdoor air flow [m³/s]; forced air flow need not be regarded
c	= specific heating capacity [J/kg°C]
ρ	= density [kg/m³]
Q	= air flow [m³/s]
α	= efficiency of heat reclamation, 0 - 1

The thermal transmittance values, U-values, can be read in tables and diagrams or be calculated if the constituent materials are known.

Energy requirement

The energy requirement for heating is determined by the output requirement and the number of degree hours required for heating to the desired temperature. The theoretical energy requirement goes down due to internal heating energy E_1.

Actual energy requirement

$$E = \frac{P_t}{t_{room} - DOT} \times °Ch + \frac{P_v}{t_{room} - DOT} \times °Ch - E_1$$

Internal heat energy
$$E_1 = P_i \times A_{floor} \times Operation \times 8760$$

°Ch = number of degree hours for heating
E_1 = internal heat energy [Wh/year] (depending on room activities, is read off in tables and diagrams)
P_i = internal heat output [W/m²]
Operation = operation time factor for internal heat output

Operation time factor is calculated from the operation time for the activity and is:
Operation = (hours/24) × (days/7)
hours = number of hours per day in operation
days = number of days per week in operation

Ventilation systems can also have operation time factors if they are run at half speed or stopped during the night.

Technical support

Frico Technical support offered free of charge :

- Output and energy calculations
- Solutions to heating problems and energy saving advice
- Dimensioning and positioning
- Solutions for heating and comfort

Contact us to discuss heating and energy savings.

On our website www.frico.se you can easily make an output calculation by filling in data about the building and and temperatures. The more precise your information is, the more certain will the results of the calculation be.

Ready reckoner, output requirement

For those who do not know all the facts about the premises an estimation of the output requirement can still be made. If you know the room volume and the desired room temperature you can read off the output requirement in the diagram below. The basis for the diagram is output requirement calculations made according to accepted methods. In the calculations, the air flow is set to one air change in the room or building per hour. It is provided that the four walls are outer walls and the roof above the ceiling is outdoors. In

the output requirement diagram A and B, the average U-value is set at 0,25 and 0,4, which is equivalent to a well insulated building. In diagram C the average U-value is set at 1.0, indicating that the building is less well insulated. The curves Δt in the diagram show the difference between room temperature and the lowest outdoor temperature.

Output requirement diagram A
Average U-value 0.25

Output requirement of the room [kW]
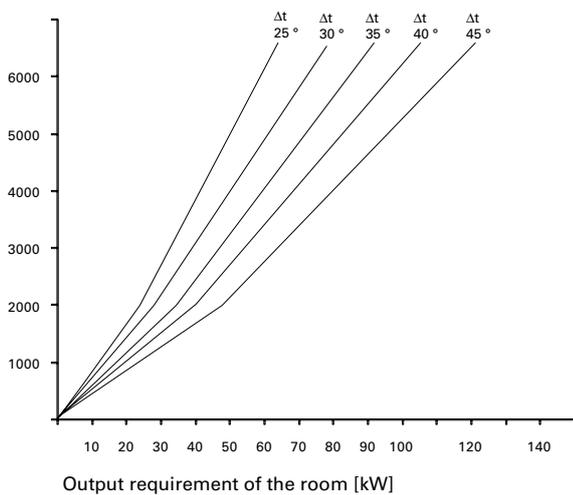
Output requirement diagram B
Average U-value 0.4

Output requirement of the room [kW]
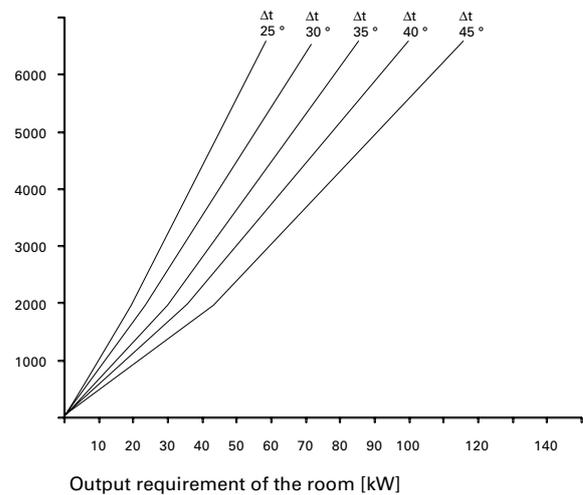
Output requirement diagram C
Average U-value 1,0

Output requirement of the room [kW]
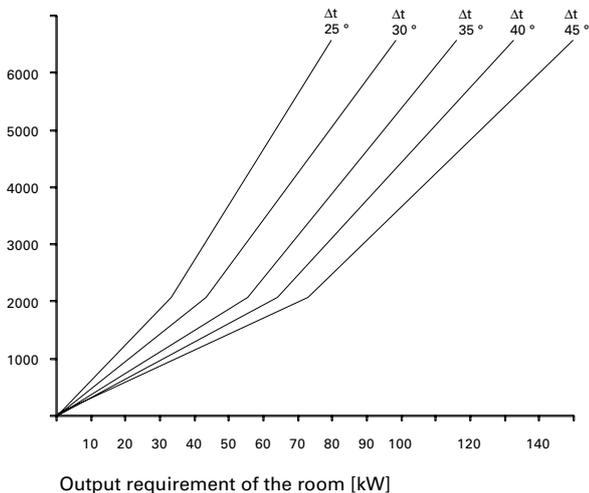
Calculation example
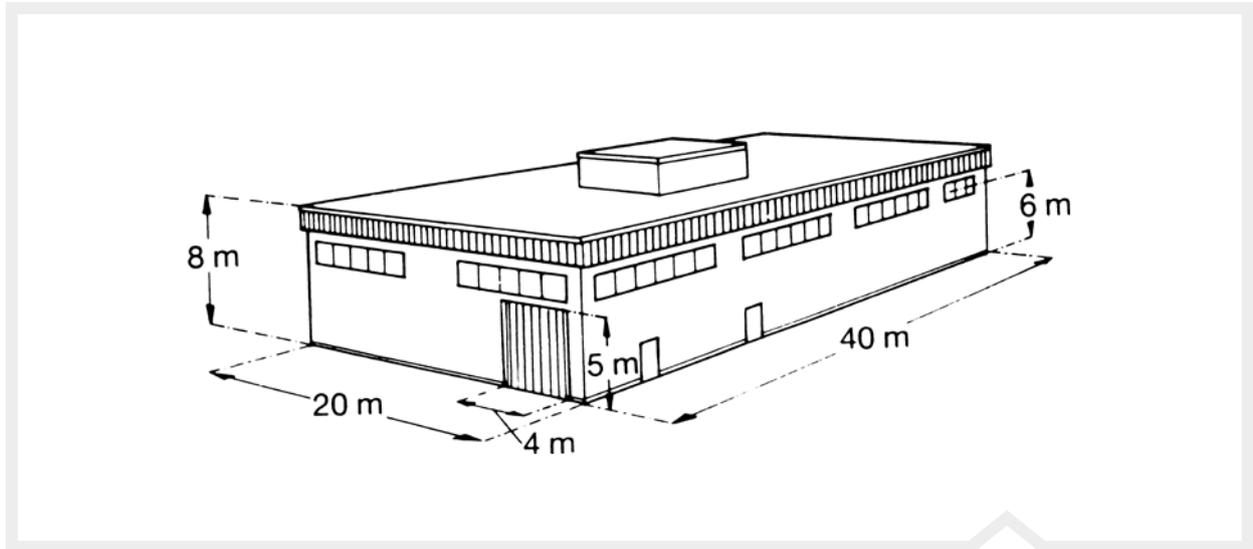
Input
Object: Industrial building

Building dimensions
Length:	40 m
Width:	20 m
Height:	8 m
Window area:	130 m²
Doors:	25 m²

Construction materials
Walls:	Light concrete block 30 cm	U = 0.6
Roof:	Light concrete block 30 cm	U = 0.6
Windows:	2-pane, 6 m above floor	U = 3.0
Doors:	Ins. sheet metal, folding door	U = 1.0

Time in operation: 12 hrs/day, 5 days a week

Ventilation
Natural ventilation, day:	0.4 ch./h
Natural ventilation, night:	0.3 ch./h
Internal heat output:	5 W/m²

Indoor temperature
Desired day temperature:	+18 °C
Desired night temperature:	+15 °C

District data
Dimensioned outdoor temperature DOT:	-18 °C
Annual average temperature:	5 °C
Average wind velocity:	4,0 m/s

Estimation

Output requirement
Transmission losses: $P_T = A \times U \times \Delta t$

	Area [m²]	U-value	Δt [°C]	Output [W]
Outer wall	805	0.6	36	17388
Roof	800	0.6	36	17280
Floor	800	0.3	36/2	4320
Window	130	3.0	36	14040
Doors	25	1.0	36	900

Total transmission losses: 53 928 W

Ventilation losses: $P_V = V_{building} \times n \times \Delta t \times 0{,}33$

	Bldg. air volume [m³]	Air changes [ch./h]	Δt [°C]	Output [W]
Day	6400	0.4	36	30413
Night	6400	0.3	33	20909

The maximum ventilation losses are during the day.

Dimensioned output requirement:
53 928 + 30 413 = 85 kW

Energy requirement
Transmission energy: $E_T = P_T/\Delta t \times °Ch$
$E_T = 53\ 928/36 \times 97\ 330 = 146$ MWh/yr

Ventilation energy: $E_V = P_V/\Delta t \times °Ch$
Day: $30413/36 \times 97330 \times 12/24 \times 5/7 = 29$ MWh/yr
Night: $20909/33 \times 97330 \times (1 - 12/24 \times 5/7) = 40$ MWh/yr

Internal heat: $E_I = P_I \times A_{floor} \times 8760$
$E_I = 5 \times 800 \times 8760 \times 12/24 = 12{,}5$ MWh/yr

Total energy requirement: $E_T + E_V - E_I = 202{,}5$ MWh/yr

Calculation example

Assume that the industrial building in the example is to be heated either with radiant heaters, e.g. industrial infrared heater IR or fan heaters. Based on that, we make a computer calculation of output and energy requirements especially for these heating methods.

The calculation program also takes the temperature gradient °C/m (temperature rise per metre of height) into consideration which is of great importance with reference to the height of the building and the method of heating.

Area and height

Bldg. ground area	800 m²
Roof area	800 m²
Building height	8 m
Window area	130 m²
Mounting height, window	6 m
Door area	25 m²
Outer walls area	805 m²

Infiltration

Air changes, day	0.4 ch./h
Air changes, night	0.3 ch./h

U-value

Window U-value	3.0 W/m² °C
Door U-value	1.0 W/m² °C
Outer wall U-value	0.6 W/m² °C
Roof U-value	0.6 W/m² °C
Floor U-value	0.3 W/m² °C

Extra heat sources

Internal heat	5 W/m²

Energy price

Electricity rate (European average)	0,2 €/kWh

	Radiant heaters	Fan heaters	Fan heaters with ceiling fans	
Temperature				
Dim. indoor temperature	17	18	18	°C
Dim. outdoor temperature	-18	-18	-18	°C
Annual average temp.	5	5	5	°C
Temperature gradient	0,3	2,5	0,3	°C/m
Night temperature	14	15	15	°C
Time in operation				
TIO day temperature	11	12	12	h/day
TIO night temperature	13	12	12	h/day
Days/week in operation	5	5	5	days
RESULTS				
Output				
Transmission losses	54 201	68 684	55 699	W
Ventilation losses	+ 30 202	+ 35 693	+ 31 046	W
Total losses	84 402	104 377	86 745	W
Internal heat	- 4 000	- 4 000	- 4 000	W
Total net output req.	80 402	100 377	82 745	W
Output req./m²	101	125	103	W/m²
Output req./m³	13	16	13	W/m³
Energy kWh/yr				
Energy req. daytime	88 075	130 340	103 787	kWh/yr
Energy req. nighttime	+ 70 252	+ 88 309	+ 71 975	kWh/yr
Total gross energy req.	158 327	218 649	175 761	kWh/yr
Internal heat	- 12 514	- 12 514	- 12 514	kWh/yr
Total net energy req.	145 813	206 135	163 247	kWh/yr
Annual operation cost	29 163	41 227	32 649	€/yr

Energy saving

A comparison of the energy requirement results from the calculations:
Industrial infrared heater IR: 146 MWh/yr
Fan heaters: 206 MWh/yr
Fan heaters and ceiling fans ICF: 163 MW/yr
Energy savings with radiant heaters: 60 MWh/yr

Radiant heater IR result in approx. 30 % lower energy consumption when compared to fan heaters. If ceiling fans are used with the fan heaters, the difference is 20 %.

Savings factors

• Low Temperature Gradient
Radiant heaters have a relatively low temperature gradient (approx. 0.3 °C/m) compared to fan heaters (approx. 2.5 °C/m). Vertical temperature is better equalized, which means lower heat losses and better use of supplied heating output in the dwelling zone.

• Radiant temperature contribution
Industrial infrared heaters also supply a radiant

temperature contribution "free of charge". The air temperature in the room can be lowered somewhat with a maintained operative (experienced) temperature. The diagram below shows how large the radiant temperature contribution is with the IR 4500. The heaters are ceiling mounted at a height of 8 metres above the floor. Measurement is done 1.5 metres above the floor. (Height above point of measure = 6.5 m.)

The diagram for radiant temperature contribution shows:
Δt_{rad} = 2 °C, A-distance 6.5 metres between the units.

$\Delta t = t_{room} + \Delta t_{rad}/2 => t_{room} = t_{op} - \Delta t_{rad}/2$

In our example: t_{room} = 18 - 2/2 = 17 °C
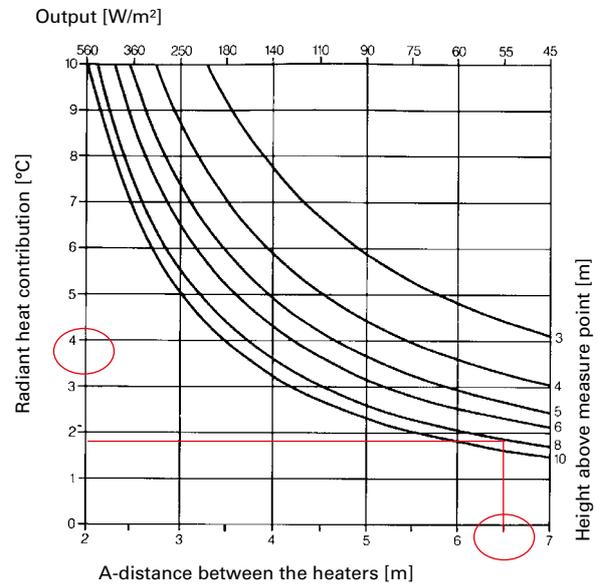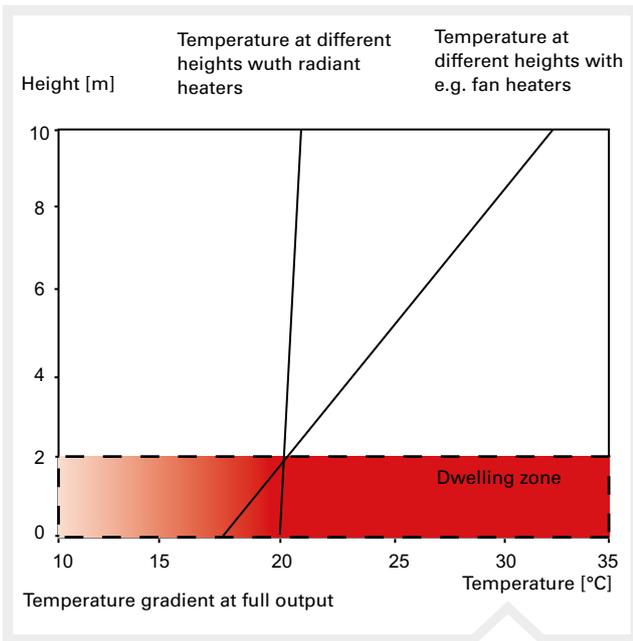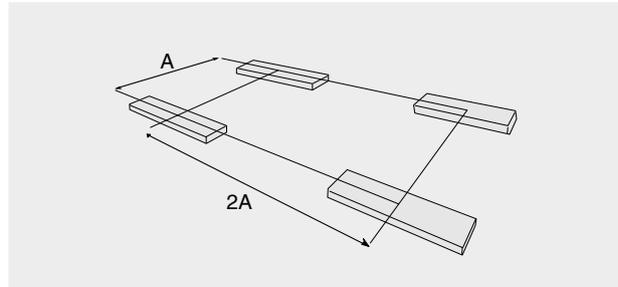
Radiant heat contribution IR 4500

• Fast heating
Heating with radiant heaters is faster than airborne heat. If we have a lower temperature at night as in the example we can lengthen the night time temperature.

Recommendation and positioning

The output requirement for the industrial building heated with infrared heater IR is just over 80 kW. Recommendation: 18 Industrial infrared heaters IR at 4.5 kW each.

Temperature gradient at full output

Tables for dimensioning

Basic electrical formulas

Amperage

Direct current and 1-phase alternating current at cosφ=1	3-phase alternating current Y-connection	3-phase alternating current Δ-connection
I=U/R=P/U	I_f=I	I=I_f √3

Voltage

Direct current and 1-phase alternating current at cosφ=1	3-phase alternating current Y-connection	3-phase alternating current Δ-connection
U=RI	U=U_f √3	U_f=U

Output

Direct current and 1-phase alternating current at cosφ=1	3-phase alternating current Y-connection	3-phase alternating current Δ-connection
P=UI	P= √3UIcosφ	P= √3 UI cosφ

U = operating voltage in volts: with DC and singlephase AC between the two conductors, with 3-phase AC two phases (not between phase and zero).
U_f = voltage between phase and zero in a 3-phase cable.
√3 ≅ 1.73
I = amperage in ampere
I_f = amperage in ampere in phase wire
R = resistance in ohm
P = output in watt

Symbols for model types

= normal design (no symbol), IPX0
● = drip-proof design, IPX1
⬛ = splash-proof design, IPX4
⬛⬛ = jet-proof design, IPX5

Enclosure classes for electrical materials

IP, first figure	Protection against solid objects
0	No protection
1	Protection against solid objects ≥ 50 mm
2	Protection against solid objects ≥ 12.5 mm
3	Protection against solid objects ≥ 2.5 mm
4	Protection against solid objects ≥ 1.0 mm
5	Protection against dust
6	Dust-tight

IP, second figure	Protection against water
0	No protection
1	Protection against vertically dripping water
2	Protection against dripping water max 15°
3	Protection against sprinkled water
4	Protection against spraying with water
5	Protection against water jets
6	Protection against heavy seas
7	Protection against short immersion in water
8	Protection against the effects of long-term immersion in water

Dimensioning table for cables and wiring

Installation wires, open or in conduit		Connection wires		
Area [mm²]	Fuse [A]	Area [mm²]	Continous current [A]	Fuse [A]
1.5	10	0.75	6	10
2.5	16	1	10	10
4	20			
6	25	1.5	16	16
10	35	2.5	25	20
16	63	4	32	25
25	80	6	40	35
35	100	10	63	63
50	125			
70	160			
95	200			
120	250			
150	250			
185	315			
240	315			
300	400			
400	500			

Dimensioning table
Current load at different outputs and voltages

Output [kW]	Connection wires					
	127/1	230/1	400/1	230/3	400/3	500/3
1.0	7.85	4.34	2.50	2.51	1.46	1.16
1.1	8.65	4.78	2.75	2.76	1.59	1.27
1.2	9.45	5.22	3.00	3.02	1.73	1.39
1.3	10.2	5.65	3.25	3.27	1.88	1.50
1.4	11.0	6.09	3.50	3.52	2.02	1.62
1.5	11.8	6.52	3.75	3.77	2.17	1.73
1.6	12.6	6.96	4.00	4.02	2.31	1.85
1.7	13.4	7.39	4.25	4.27	2.46	1.96
1.7	14.2	7.83	4.50	4.52	2.60	2.08
1.9	15.0	8.26	4.75	4.78	2.75	2.20
2.0	15.8	8.70	5.00	5.03	2.89	2.31
2.2	17.3	9.67	5.50	5.53	3.18	2.54
2.3	18.1	10.0	5.75	5.78	3.32	2.66
2.4	18.9	10.4	6.00	6.03	3.47	2.77
2.6	20.5	11.3	6.50	6.53	3.76	3.01
2.8	22.0	12.2	7.00	7.03	4.05	3.24
3.0	23.6	13.0	7.50	7.54	4.34	3.47
3.2	25.2	13.9	8.00	8.04	4.62	3.70
3.4	26.8	14.8	8.50	8.54	4.91	3.93
3.6	28.4	15.7	9.00	9.05	5.20	4.15
3.8	29.9	16.5	9.50	9.55	5.49	4.39
4.0	31.15	17.4	10.0	10.05	5.78	4.62
4.5	35.4	19.6	11.25	11.31	6.50	5.20
5.0	39.4	21.7	12.50	12.57	7.23	5.78
5.5	43.3	23.9	13.75	13.82	7.95	6.36
6.0	47.3	26.1	15.0	15.1	8.67	6.94
6.5	51.2	28.3	16.25	16.3	9.39	7.51
7.0	55.0	30.4	17.50	17.6	10.1	8.09
7.5	59.0	32.6	18.75	18.8	10.8	8.67
8.0	63.0	34.8	20.0	20.1	11.6	9.25
8.5	67.0	37.0	21.25	21.4	12.3	9.83
9.0	71.0	39.1	22.5	22.6	13.0	10.4
9.5	75.0	41.3	23.75	23.9	13.7	11.0
10.0	78.5	43.5	25.0	25.1	14.5	11.6

For outputs between 0,1 and 1 kW, the amperage read is multiplied by 0.1. For outputs between 10 and 100 kW, the amperage read is multiplied by 10.

Climate data

Place	Av. daily temp [°C]	Extremes in Dec. [°C]	Av. wind speed [m/s]
Scandinavia			
Tromsö	2.9	-14.9	3.0
Karesoando	-1.5	-30.2	1.5
Sodankyle	-0.4	-43.1	3.0
Trondheim	4.9	-20.2	3.2
Vaasa	3.5	-30.2	3.8
Bergen	7.8	-8.4	3.2
Oslo	5.9	-20.2	2.2
Stockholm	6.6	-16.3	3.8
Göteborg	7.6	-15.8	4.0
Copenhagen	8.5	-11.4	2.3
British isles, France, Belgium, The Netherlands, Luxemburg			
London	10.4	(-12)	-
Eelde	8.7	-14.6	5.3
De Bilt	9.3	-20.8	3.3
Ostend	9.9	-13.5	6.5
Brussels	9.9	-16.0	3.8
Lille	9.7	-14.0	4.5
Luxemburg-City	8.8	-15.2	
Le Havre	10.6	-7.8	-
Paris	10.9	-13.2	3.9
Strasbourg	9.7	-21.0	2.2
Brest	10.8	-5.0	5.0
Tours	11.2	-18.0	3.7
Nantes	11.7	-10.8	3.6
Lyon	11.4	-24.6	3.0
Bordeaux	12.3	-13.4	3.1
Tolouse	12.5	-10.5	3.6
Marseilles	14.2	-12.8	4.4
Ajaccio, Corsica	14.7	-3.6	2.6
Iberian Peninisula			
Santander	13.9	-0.2	3.6
Barcelona	16.4	-2.5	2.2
Oporto	14.4	-3.7	5.1
Madrid	13.9	-6.5	2.7
Palma de Mallorca	16.8	-1.5	2.8
Losbon	16.6	0.0	4.1
Sevilla	18.8	-2.8	1.7
Malaga	18.5	2.0	2.1
Poland, Czech Republic, Slovakia, Hungary			
Gdynia	7.9	-14.8	3.6
Warsaw	8.1	-18.9	4.1
Cracow	8.6	-17.1	2.7
Prague	7.9	-20.4	-
Ostrava	8.1	-27.9	-
Bratislava	9.6	-22.8	3.4
Budapest	11.2	-19.1	2.3
Pecs	11.5	-	3.3

Place	Av. daily temp [°C]	Extremes in Dec. [°C]	Av. wind speed [m/s]
Central Europe			
List auf Sylt	8.4	-8.0	6,7
Greifswald	8.3	-17.4	5,3
Hamburg	8.4	-16.4	4,2
Dresden-Wahnsdorf	8.6	-20.3	4,9
Aschen	9.7	-16.5	3,0
Karlsruhe	10.1	-21.5	2,3
Vienna	9.8	-15.3	3,0
Salzburg	8.1	-27.7	2,0
Garmisch-Partenkirchen	6.3	-22.7	1,3
Zurich	8.5	-19.3	2,8
Innsbruck	8.6	-24.8	1,3
Graz	8.3	-19.0	1,4
Geneva	10.3		-
Italy			
Milan	3.8	-7.0	-
Genoa	9.2	-2.8	-
Florence	14.4	-8.0	-
Rome	15.6	-5.0	-
Naples	16.8	-1.6	-
Mesina	17.9	-0.2	-
Southeast Europe			
Zagreb	11.6	-26.3	-
Belgrado	11.8	-19.3	-
Bucharest	11.1	-19.9	2,0
Sarajevo	9.8	-22.4	1,4
Sofia	10.4	-20.3	2,0
Skopje	12.4	-21.8	-
Tirana	16.0	-8.0	1,5
Thessalonki	16.1	-	-
Athens	17.8	-	2,0
Eastern Europe and Russia			
Murmansk region	-0.6	-	4,2
Arkhangeslk region	-1.0	-	-
Moscow	4.9	-	-
St Petersburg region	4.4	-	3,6
Baltic Countries	6.2	-	5,0
Belarussia	6.3	-	3,4
Kiev	7.6	-	-
Novosibirsk	1.0	-	-

Heat insulation, U-value

U = thermal transmittance value [W/m² °C]
U-values indicate the heat insulating capacity of a
building section. The following equation can be used
to calculate U-values:
$1/U = R_{si} + R + d_1/\lambda_1 + d_2/\lambda_2 + ...+ d_n/\lambda_n + R_{se}$

R = heat resistance [m² °C/W]
R-values indicate the heat insulating capacity of a product or building section.
R_{si} = heat transmission resistance upon transmission from internal air to wall
surface [m² °C/W].
R_{se} = heat transmission resistance upon transmission
from fresh air to wall surface [m² °C/W].
d_1, d_2, ...d_n = thickness for respective materials [m].
λ_1, λ_2,....λ_n = heat conductivity [W/m °C].

Material	U-value [W/m² °C]
Walls	
New building	
Wooden fascia with 15 cm insulation and plaster	0,27
Wooden fascia with 20 cm insulation and plaster	0,25
Wooden fascia with 25 cm insulation and plaster	0,22
Brick fascia with 15 cm insulation and plaster	0,27
Brick fascia with 20 cm insulation and plaster	0,24
Light concrete with 15 cm insulation	0,25
Light concrete with 20 cm insulation	0,2
Sheet metal fascia with 5 cm insulation	0,8
Sheet metal fascia with 10 cm insulation	0,4
Sheet metal fascia with 15 cm insulation	0,3
New construction for low energy house	0,18
Warehouse	0,3
One layer PVC (900 g)	5,0
Insulated hall (Thermohall)	0,6
Older building	
Single brick 12 cm	1,8
1 1/2 brick 18 cm	1,1
Light concrete block 20 cm	0,8
Light concrete block 30 cm	0,6
Concrete 15 cm	2,8
Concrete with 5 cm insulation	0,8
Concrete with 10 cm insulation	0,4
Frame wall with 5 cm insulation	0,8
Frame wall with 10 cm insulation	0,4
Frame wall with 15 cm insulation	0,3
New construction	0,3
Roof	
New building	
Sheet metal pitched roof, with 20 cm insulation	0,24
Brick pitched roof, with 20 cm insulation	0,23
Older building	
Concrete beam frame 15 cm	2,8
Concrete beam frame with 5 cm insulation	0,8
Concrete beam frame with 10 cm insulation	0,4
Light concrete 20 cm	0,8
Light concrete 30 cm	0,6
Sheet metal roof, uninsulated	4,0
Sheet metal roof with 5 cm insulation	0,8
Sheet metal roof with 10 cm insulation	0,6
Sheet metal roof with 25 cm insulation	0,2

Material	U-value [W/m² °C]
Windows	
New building	
1+1 pane window (1 outer pane and 1 insulated pane)	2,5
2 pane window (2 insulated panes)	2,7
2+1 pane window (1 outer pane and 2 insulated panes)	1,0
3 pane window (3 insulated panes)	1,2
Energy class A	0,9
Energy class B	1,0
Energy class C	1,1
Energy class D	1,2
Energy class E	1,3
Energy class F	1,4
Energy class G	1,5
Older building	
1 pane window	5,0
2 pane window	3,0
3 pane window	2,0
3 pane window insulation pane	1,8
Door	
Sliding entry with full panels	0,8
Sliding entry with windows and door	1,3
Folding door with windows	2,2
Folding door fully glazed	3,4
Single front door without glass	1,0
Single front door with glass	3,4
Double front door without glass	0,7
Double front door with glass	1,7
Floor	
New building	
Floor with 10 cm insulation	0,2
Floor with 15 cm insulation	0,16
Floor with 20 cm insulation	0,13
Older building	
< 300 m²	0,4
> 300 m²	0,3

Technical handbook

Temperature gradients

Convector heating	2 - 2,5 °C/m
Hot air heating - fan heaters	2 - 2,5 °C/m
Radiators and hot air heating	1,7 °C/m
Radiator heating	1,2 °C/m
Radiant heaters	0,2 - 0.4 °C/m
Floor heating	~0,1 °C/m

Values apply at full output.

Internal heat

Activities	W/m² floor area	W/employee
Shop	15	
Cafeteria	15	
Office	0-20	100
Sports centre	10	
Bakery	30	
Steel mill	50-70	
Car workshop	15	
Mechanical workshop	20	
Heavy workshop	50	
Sheet metal/welding	25	

Energy equivalents

Quantity and substance	Energy quantity [MWh]
1 m³ oil	8.000
1 Nm³ liquid propane gas	0.022
1 Nm³ natural gas	0.009
1 Nm³ town gas	0.004
1 kg liquid propane gas	0.087
1 kg natural gas	0.007
1 kg town gas	0.003

Heat conductivity

Material	λ-values [W/m°C]
Natural stone	2.4-3.6
Chalky sandstone	1.0
Concrete	1.7
Light clinker concrete	0.6
Brick and concrete hollow block	0.6
Cement mortar	1.0
Wood, particle board	0.14
Plaster board	0.22
Plywood	0.13
Fibre board	0.08
Mineral wool	0.045
Cellular plastic	0.04

Heat resistance R

Material	R heat resistance [m²°C/W]
Internal + external transmission resistance Rsi + Rse	0.17
Cellar wall, underground 1-2 metres	1.0
Below floor on ground Outer verge zone	0.7
Below floor on ground inner verge zone	2.0

Infiltration

Building	Air change/h
New building	
< 1000 m²	0,3
> 1000 m²	0,1
Older building	
< 1000 m²	0,4
> 1000 m²	0,2

Ventilation air flow

The following equation can be used for calculating the ventilation air flow:

$$Q = q \times A_{floor} \times 3.6 \quad \text{or} \quad Q = n \times V_{bldg}.$$

where
- q = air flow [l/sm²]
- n = number of air changes per hour
- A_{floor} = floor surface of the building [m²]
- V_{bldg} = volume of the building [m³]

Airflows below are only recommendations.

Building	l/s m²	l/s person	Air change/h
Shop	2.1	7	4-5
Cafeteria	5	7	6.0
Public building	0.35	+7	3.0
Office	0.35	+7	1-2
School	0.35	+7	4-5
Sports centre	2.1	7	2.0
Bakery	6		6.0
Steel mill	40.0		10-15
Car workshop	30		3.0
Mechanical workshop	0.35	+7	5.0
Sheet metal/welding	5.0		5.0
Meeting-hall/smoking		20	8.0
Meeting-hall/no smoking	7	7	6.0
Minimum req.	0.35		ca 0.5

Energy efficient products for a comfortable indoor climate

Air curtains
It makes sound economic sense to create an efficient and invisible door that keeps the heat inside. Air curtains can be even more effective when used in air conditioned or cold storage buildings.

Thermozone technology with its precisely adjusted air velocity gives even protection throughout the opening. Frico air curtains provide the most efficient separation with the lowest possible energy consumption, regardless of whether it is the heat or the cold that you want to keep inside.

Radiant heaters
Frico radiant heaters imitate the sun, the most comfortable and efficient heat source available. The heat is emitted only when the rays hit a surface and the room temperature can thus be lowered while occupants experience a comfortable environment. This makes radiant heaters well suited not only for total heating but also for zone and spot heating, for example to avoid cold draughts from windows.

Radiant heaters are easy to install and require minimum maintenance. They heat directly when switched on and give no air movement.

Fan heaters
We are proud of the worldwide fame Frico fan heaters have gained. They are reliable and are designed for long life. Our range covers all needs. The investment cost is low compared to other heating systems.

A great advantage of fan heaters is the option of combining heating and ventilation. Frico fan heaters are compact, silent and light weight. They are available for electrical heating as well as for water heating.

Convectors
Convection is the term for the rotating air movement where the air is affected by a heat source. The air is heated - rises upwards - cools and comes back to then be reheated. This gives good comfort through good heat distribution and the warm air flow directed upwards can be used to counteract cold drafts from large glass surfaces.

Ceiling fans
Ceiling fans force over-heated air from the ceiling down to the occupation zone in premises with high ceilings so that the heat is maximally exploited. The ceiling fans can also be run in reverse, so that cold air can circulate through the room giving it a cooler feel.

Thermostats and controls
The key to energy efficient heating and good comfort is the combination of heating products and good controls. Frico offers a wide range of thermostats and controls, read more under each product or in the Frico Catalogues.

FRICO