Product catalogue | **Fan Heaters and Convectors**

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Frico saves energy

Thanks to our broad product range and our many years of experience, Frico is able to help you save energy. By offering total solutions, including both complete heating systems and products for additional heating, we can generate a comfortable indoor climate at a low energy cost. Our regulation systems for different levels ensure that you never use more energy than is required. Through our parent company, Systemair, we also possess knowledge about ventilation and can provide appropriate solutions.

Local Climate. Global Comfort – what does it mean?

At Frico, we are proud to be able to offer energyefficient 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.

The four words ”Local Climate. Global Comfort” summarise what we at Frico stand for. Our products manage the local climate; in business complexes, industrial buildings, offices or summer cottages. Our products also help to create a healthy planet and with optimum energy efficiency, we ensure that our products are climate-smart.

We are here

Frico's headoffice is located outside Gothenburg in Sweden and we are a part of the Systemair Group. Today Frico is represented in 85 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.

Good reasons to choose Frico

More than 75 years of experience of 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 technique and design
Frico is the leading supplier of air curtains, radiant heaters and fan heaters in Europe. All our products are well designed in good Scandinavian tradition.

Knowledge and resources
Since we develop our own products, our knowledge on how to create an energy efficient indoor climate is constantly growing. We have one of Europe's most modern and advanced air and sound laboratories to aid us.

Frico Academy
The 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.

Qualified local support
Frico is present locally in some 85 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.

Quality and long life
Frico offers consistent and high product quality. Our product warranty is there for your safety. It covers manufacturing faults and is valid for three years.

Frico products are designed for long life and are easy to maintain. Through our distribution network we provide reliable maintenance and service support which includes the availability of spare parts for at least ten years.

References
Our products create comfortable indoor climates all over the world. Below are some of our references.

- Odeon, London
- Eiffel Tower, Paris
- Moscow Metro, Moscow
- Hurtigrutten, Norway
- Wasa Museum, Stockholm
- LKAB mine, Sweden
- Changan Theatre, China
- McDonald's

More references can be found on www.frico.se.

Our product groups

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.

THERMOZONE® TECHNOLOGY

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.

The Frico story

Frico has a long tradition of creating technically highly developed, quality products for a comfortable indoor climate. Friberg and Co was founded in 1932 by civil engineers Mr. Eggertz and Mr. Friberg. The product groups we now offer have been introduced gradually. We have employed the same approach in starting up subsidiaries and distributors around the world.

Quality and sustainable design

Quality has always been a well known characteristic of Frico products, as well as high technical functionality. Beginning in 1956 research was emphasized and the final testing of all products was introduced to ensure that our high quality requirements are met.

Frico's oldest product still offered in the range is the ribbed pipe radiator that was introduced in the late 1930s. This product has even found a new market in modern houses and is popular among architects. Our aim is for all our products to become classics. They should have high quality, the best performance and a design that lasts.

5 August 1932
Friberg & Co is founded

1955
Fan heaters

1960
Frico goes abroad

1938
The ribbed pipe radiator

1956
Technology and testing

1967
Radiant heaters

Frico's future

The demand for energy-saving products is increasing worldwide, along with increased environmental awareness and willingness to conserve the Earth's resources. Our experience of Sweden's changing climate means that we have traditionally always focused on energy efficiency in the development of our products.

As the market leader are at the forefront of the development of air curtains and heating products. We offer products for the worldwide market, regardless of climate, and we have products for both electrical and water heating. With more than 75 years of combined expertise and Europe's most advanced testing facility at our disposal, we will continue to supply climate-smart solutions.

1973
Air curtains

1994
Frico SAS, France
Frico rep. office in Russia

2004
Frico GmbH, Germany
Frico BV, Holland

2006
Frico GmbH, Austria

1981
Frico AS, Norway

1992
Merge with Systemair

2001
Frico Ltd, United Kingdom
Frico rep. office in China

2005
Frico rep. office in Spain

Research and development

Regular tests and measurements are made to develop new, but also to improve our existing, products.

Temperature measurements in the black corner

In the black corner both external and internal temperatures are measured on the product as well as on walls and ceilings. Black surfaces have a very high capacity to absorb heat radiation and therefore give the least advantageous conditions during our tests.

The product is mounted according to the minimum distances to ceiling, walls and floor given in the manual. The temperatures are then registered in a data logger using the thermo-elements placed on the black corner and apparatus surfaces. The temperature inside the apparatus is measured and checked to ensure that the it meets the requirements regarding safety standards.

Black corner

Air and sound tests

Our test facility for air and sound is among the most modern in Europe. The measurements are carried out according to the AMCA and ISO standards. AMCA stands for the "Air Movement Control Association", an international, non-profit organisation that contributes towards setting standards for the entire air industry.

The acoustic room has no parallel surfaces, sound-waves are therefore prevented to meet and to interrupt each other. The room also rests on 76 springs that eliminate vibration from the production. The background noise is 9 dB(A).

Airflow measurement

The air curtain or the fan heater blows into the zero pressure chamber. At the opposite end of the rig is a suction fan which readjusts the pressure to zero. The pressure difference (at zero pressure) is measured using nozzles. The nozzles are designed according to AMCA standard. The airflow is derived from the pressure difference. AMCA standard defines the airflow that equals each pressure difference.

Airflow measurement

More than 75 years of collected knowledge

Not only does 75 years of experience provide us with invaluable knowledge in designing high quality products with the best performance, it also enables us to provide a knowledge bank that can be accessed on the web, in our printed material or can be obtained by contacting us or our distributors. We welcome you to share our knowledge!

Web
Get inspiration from our references and updated information from the product database which includes product details, manuals, wiring diagrams and pictures. Make sure you check out www.frico.se for the latest updated product information, references, news, etc.

Catalogues
The Frico catalogues contains in-depth information on all the products in our range, as well as the theoretical underpinnings. There are three catalogues, one for air curtains, one for radiant heaters and one for fan heaters and convectors. All catalogues include suitable regulators and accessories.

Mini catalogue
The mini catalogue presents brief information and basic technical data on all our products in one edition.

Assortment folders
Assortment folders give an overview of the product groups air curtains, fan heaters and radiant heaters in three separate editions.

Concept folders
For more specific applications we have produced the concept folders. Today they include the applications Entrances, Industry, Open air restaurants, Petrol Stations, Cold Storage and Martime environments.

Marketing support
We are happy to provide you with the digital material of all of the above for your own presentations, translation, printing etc. We can also provide you with templates for marketing material such as advertising, banners etc.

Fan heaters

For decades Frico has been the world leader in fan heater design. Today we have a complete range of high quality equipment modelled on the demanding climate of Scandinavia. Frico's worldwide distribution network encounters many different environmental conditions, such as storage rooms, pump rooms, building sites, mines, sports centres, shops, drying rooms, stables, boats, etc.

We are proud of the worldwide acclaim we have gained through our line of fan heaters. They are known as reliable and long-lasting products. The heaters are also robust and will withstand rough treatment in aggressive environments, at the same time having the lowest sound level on the market.

Exceptionally quiet

One of the most important tasks in our product development, is the construction of low noise fan heaters.

At our plant in Skinnskatteberg, Sweden, you will find one of the most sophisticated air and sound laboratories in Europe, staffed by highly skilled technicians making it possible to manufacture products of the finest quality.

Lots of power, small investment

Compared to other heating systems, the investment cost for fan heaters is low. Frico fan heaters give you lots of power for the money.

Compact and robust

Frico fan heaters are compact and light. Therefore they are easy to carry or can easily be mounted on the wall.

The heaters are also very robust and withstand heavy handling in aggressive environments.

Electricity or water?

Frico fan heaters are available for electrical or water heating - you have the choice!

Heating and ventilation

A great advantage of fan heaters is the option of combining heating and ventilation. Mixing cabinets for stationary fan heaters create economic heating and ventilation, by mixing the return air with fresh air.

Fan heaters - electrically heated

Compact
K21 is a compact and safe fan heater designed for portable use. Ideal for heating small areas, for example, garages, caravans, awnings, weekend cottages, offices, patios, etc.

Versatile
Tiger is a range of robust and compact fan heaters for professionals with high demands. The Tiger fan heater is portable, models up to 15 kW can also be hung on the wall.

Tiger 2-9 kW are intended for heating and drying areas such as garages, workshops and shops.

Tiger 15, 20 and 30 kW are ideal for heating and drying larger premises such as industrial premises and workshops, where higher outputs are required.

Hard wearing
Elektra is a range of fan heaters designed for use in demanding environments. The different models can be used anywhere from corrosive environments and combustible areas to rooms with high temperatures as well as onboard ships and offshore platforms. Elektra is mainly designed for stationary use, yet can also be used as a portable fan heater.

Discret
Cat is a range of compact and quiet fan heaters for stationary use. It is ideally suited for small stockrooms, in a garage, workshop or shop.

Flexible
Panther 6-15 is a range of very quiet and efficient fan heaters for stationary use. They are intended for heating, drying and ventilation in e.g. workshops, sport halls, shops, assembly rooms and drying rooms.

Powerful
Panther 20–30 is a range of powerful and quiet fan heaters for stationary use. They are intended for heating, drying and ventilation of large premises, for example, industries.

2 kW Electrical heat

1 model CE

Fan heater K21

Small and portable fan heater with high output temperature

Application

K21 is a compact and safe fan heater designed for portable use. Ideal for heating small areas, for example, garages, caravans, awnings, weekend cottages, offices, patios, etc.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. With a portable fan heater it is easy to move and take the heat where it is required. The K21 fan heater only weighs 2.5 kg but has an output of 2000 W.

Operation and economy

Frico's fan heaters have a long life and providing fast and effective heating at a low cost. A portable fan heater gives good personal comfort without the need to heat the whole premises, which keeps heating costs to a minimum.

Design

K21 fan heater is small and compact in white metal finish and is equipped with a solid handle.

Product specifications

- Self-regulating ceramic PTC element that can not be overheated.
- Intensive and concentrated heat emission. The air is heated to approx. 65 °C when it passes through K21.
- Equipped with 2 metre long cord with plug for connection to an earthed outlet socket.
- Thermostat (+5 – +35 °C) and output selector (0/1/2 kW).
- Outer casing in white enamelled sheet steel. Colour: RAL 9016, NCS 0502-B (white).

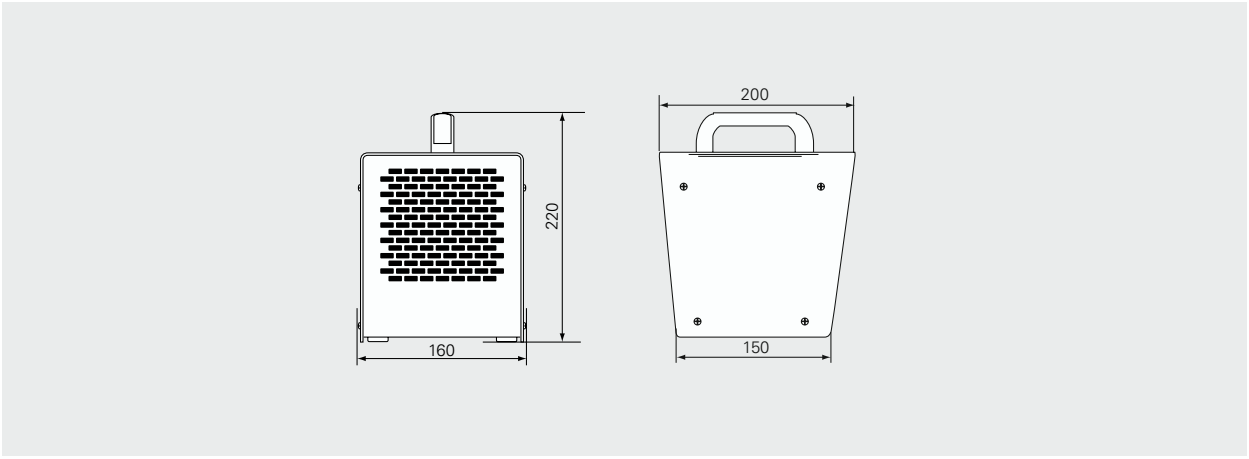
Technical specifications | Fan heater K21

Type	Output steps [kW]	Airflow [m³/h]	Sound level*1 [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
K21	0/1/2	90	43	62	230V~	8.9	220x160x200	2,5

*1) Conditions: 5 meters distance to the unit.
*2) Δt = temperature rise of passing air at maximum heat output.

Protection class: IP21.
Approved by SEMKO and CE compliant.

Dimensions



Mounting and connection

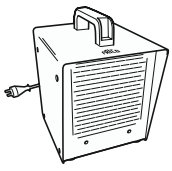
The K21 fan heater is portable and equipped with a 2 metre long cord with plug for connection to an earthed outlet socket.

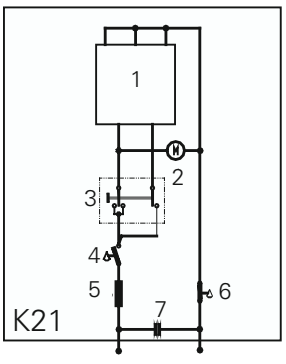
Controls

The K21 fan heater has an integrated thermostat (+5 – +35 °C) and output selector (0/1/2 kW).

Wiring diagrams

Internal wiring diagram





230 V~

1. PTC element
2. Fan
3. Switch
4. Thermostat
5. Fuse
6. Overheat protection
7. Disturbance eliminator capacitor

2–30 kW Electrical heat

9 models CE

Fan heater Tiger

Robust fan heater for portable use in demanding environments

Application

Tiger is a range of robust and compact fan heaters for professionals with high demands. The Tiger fan heater is portable, models up to 15 kW can also be hung on the wall.

Tiger 2-9 kW are intended for heating and drying areas such as garages, workshops and shops.

Tiger 15, 20 and 30 kW are ideal for heating and drying larger premises such as industrial premises and workshops, where higher outputs are required.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. With a portable fan heater it is easy to move and take the heat where it is required.

Operation and economy

Frico's fan heaters have a long life and providing fast and effective heating at a low cost. A portable fan heater gives good personal comfort without the need to heat the whole premises, which keeps heating costs to a minimum.

Design

The Tiger fan heater has a compact and robust sheet steel design with a red finish. The heavy-duty tubular frame acts as a well-balanced and ergonomic carrying handle. The design protects against impact and vibrations and permits use in exacting environments.

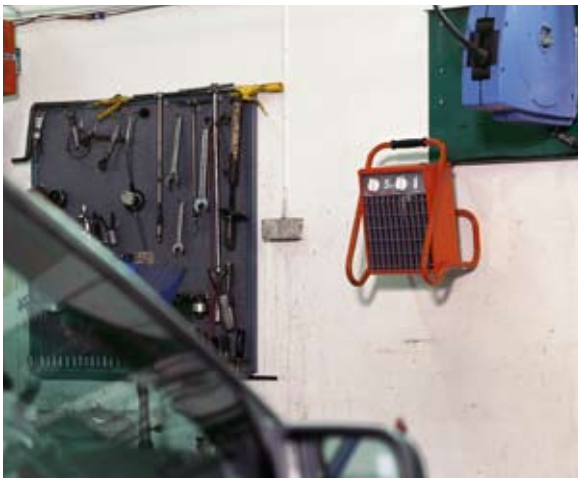
Product specifications

- The Tiger fan heater is available in the following designs:
  - **P21 and P31** have a 1.8 m cord with plug for connection to earthed outlet sockets. Can be hung on the wall.
  - **P33, P53 and P93** have a 1.8 m cable with CEE-plug. 230V-outlet socket (type E) at the rear. Can be hung on the wall.
  - **P153** has a 1.8 m cable with CEE-plug. Can be hung on the wall.
  - **P203, P303 and P305** are supplied with a 1.8 m cable without a plug. P305 can be connected to 440V3~ and 500V3~.
- Low sound level.
- Very reliable and well protected against impact and vibrations.
- Integrated thermostat with setting range +5 – +35 °C and output selector.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels.
  Colour: RAL 3020, NCS 1090-Y80R (red).



The robust and portable design combined with an output of 30 kW makes Tiger unbeatable in tough environments with demand for temporary heating. The heavy-duty tubular frame acts as a well-balanced and ergonomic carrying handle.

Tiger 3-9 kW (400V3N~) has a 230V outlet at the rear for easy connection of e.g. lighting or a charger for cordless tools. Practical for building sites!



Tiger is primarily intended for portable use, but the 2–15 kW models can easily be wall mounted to be out of the way.

Technical specifications | Fan heater Tiger, 2-9 kW

Type	Output steps [kW]	Airflow [m³/h]	Sound level*1 [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
P21	0/2	280	41	22	230V~	8.8	450x290x390	5.7
P31	0/2/3	280	41	32	230V~	13	450x290x390	6.0
P33*3	0/1.5/3	280	41	32	400V3N~*3	4.4	450x290x390	6.3
P53*3	0/2.5/5	480	40	31	400V3N~*3	7.3	450x290x390	6.7
P93*3	0/4.5/9	720	44	37	400V3N~*3	13	530x350x480	10

Technical specifications | Fan heater Tiger, 15 kW

Type	Output steps [kW]	Airflow [m³/h]	Sound level*1 [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
P153	0/7.5/15	1120	47	40	400V3N~	21.9	510x410x530	16

Technical specifications | Fan heater Tiger, 20 and 30 kW

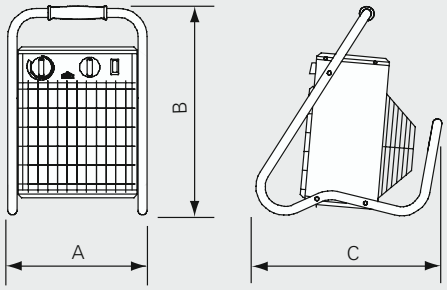
Type	Output steps [kW]	Airflow [m³/h]	Sound level*1 [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
P203	0/10/20	1900/2600	60	31/23	400V3N~	29.5	590x630x600	26
P303	0/10/20/30	1900/2600	52	47/34	400V3N~	43.9	590x630x600	30
P305*4 (convertible)	0/7.5/15/23 0/10/20/30	1900/2600	52	36/26 47/34	440V3N~*4 500V3N~	30.8 35.1	590x630x600	30

*1) Conditions: Distance to the unit 3 metres. Directional factor: 2. Equivalent absorption area: 200 m².
*2) Δt = temperature rise of passing air at maximum heat output and lowest/highest air flow.
*3) Also available without neutral and are then called P33-0, P53-0 and P93-0. These models do not have a 230 V~ socket on the back.
*4) Can be connected to 440V3~ och 500V3~

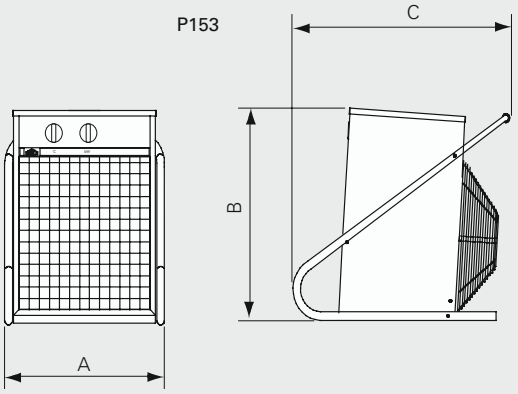
Protection class: IP44.
CE compliant.

Dimensions

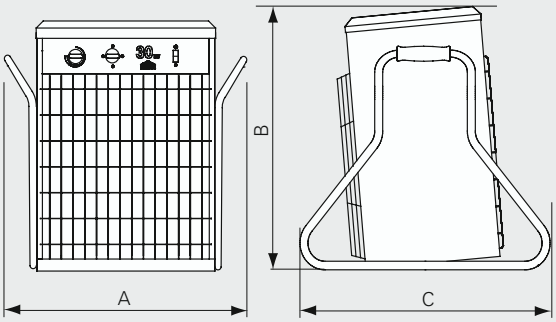
P21, P31, P33, P53, P93



P153

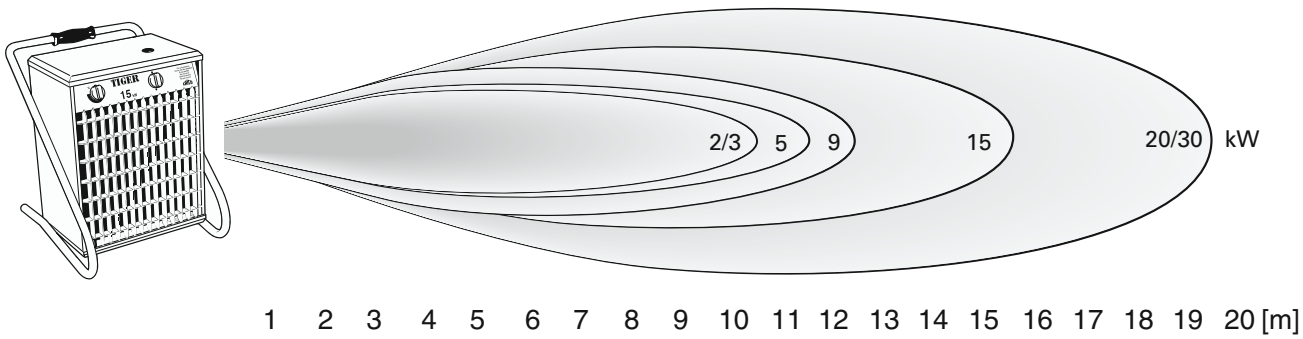


P203, P303, P305



	A [mm]	B [mm]	C [mm]
P21, P31, P33, P53	290	450	390
P93	350	530	480
P153	410	510	530
P203, P303, P305	630	590	600

Air throw



Mounting and connection

Mounting

The Tiger fan heater is portable. Units up to 15 kW can easily be installed on the wall. The holes at the rear of the frame can be used for permanent wall installation. If the unit needs to be moved the wall bracket LT22406 (see diagram 2) can be ordered free of charge. For minimum dimensions with permanent installation, see diagram 1.

Electrical installation

The Tiger fan heater is equipped with a 1.8 metre long connection cable.

- P21 and P31 have cords with plugs for connection to earthed outlet sockets (P21 requires 10 A fuse protection, P31 requires 16 A fuse protection).
- P33, P53, P93 and P153 all have a CEE plug fitted on the connection cable. There is a 230V-outlet socket of the type E that is compatible with type E as well as E/F-hybrid (CEE 7/7) at the rear of P33, P53 and P93, the socket gives the possibility to connect, for example, lighting or a charger for cordless tools.
- P203, P303, P305 are supplied with a cable without a plug. P305 can be connected to both 440V3~ and 500V3~.

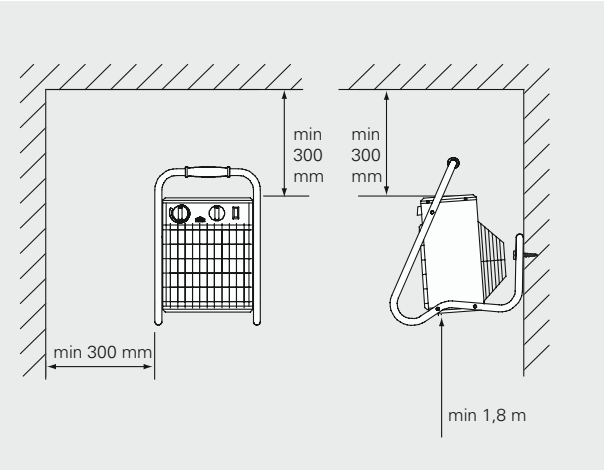


Fig. 1: Minimum distance for fixed installation.

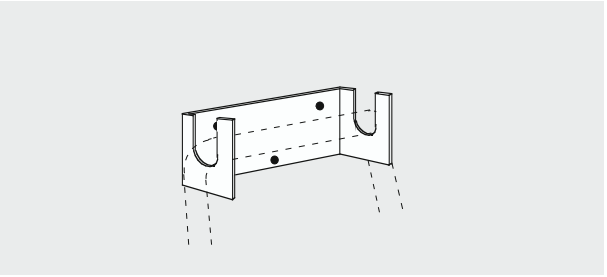


Fig. 2: Mounting with mounting bracket LT22406.

Controls

Tiger, 2–9 kW

The built-in thermostat controls fan speed and heat, or heat only. The choice is made with the mode selector. When operating with heat only the fan blows constantly and the thermostat only controls the heat output. Thermostat with setting range 5–35°C. Output is set via the output selector.

Tiger, 15 kW

Built-in thermostat with setting range 5–35°C. Output is set via the output selector, for steps see table.

Tiger, 20 and 30 kW

Built-in thermostat with setting range 5–35°C.
Output is set via the output selector, for steps see table.
The mode selector has two different fan speed positions.

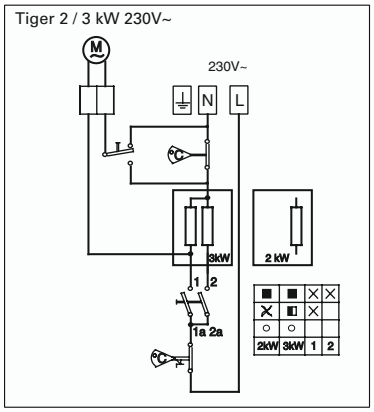
Accessories

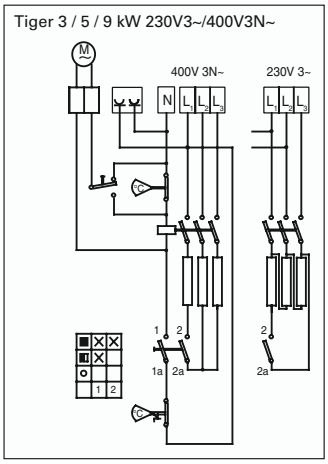
Type	Description	HxBxD [mm]
LT22406	Wall bracket for Tiger 2-15 kW	45x128x40

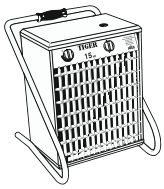
Wiring diagrams

Internal wiring diagram

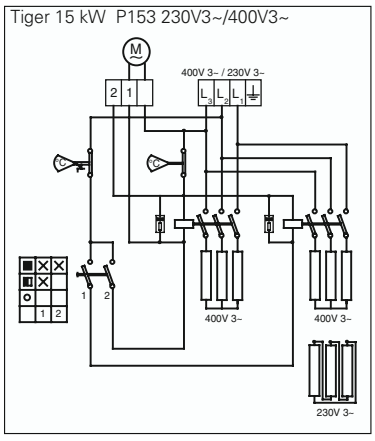
Tiger 2/3/5 kW

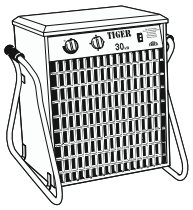




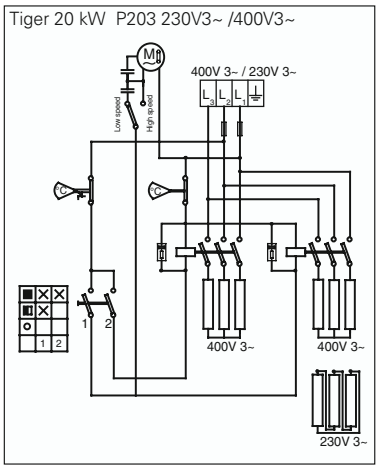


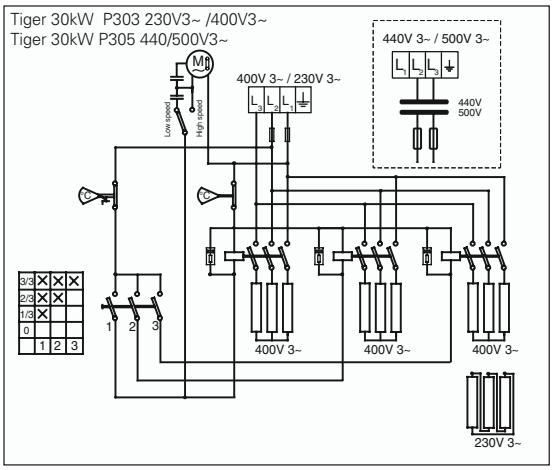
Tiger 15 kW





Tiger 20/30 kW





3-15 kW Electrical heat

14 models

Elektra - C/F/V/H

Hard wearing fan heaters for very demanding environments

Application

Elektra is a range of fan heaters designed for use in demanding environments. The different models can be used anywhere from corrosive environments and combustible areas to rooms with high temperatures as well as onboard ships and offshore platforms. Elektra is mainly designed for stationary use, yet can also be used as a portable fan heater.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. The Elektra fan heater makes it possible to bring comfort to environments with special requirements.

Operation and economy

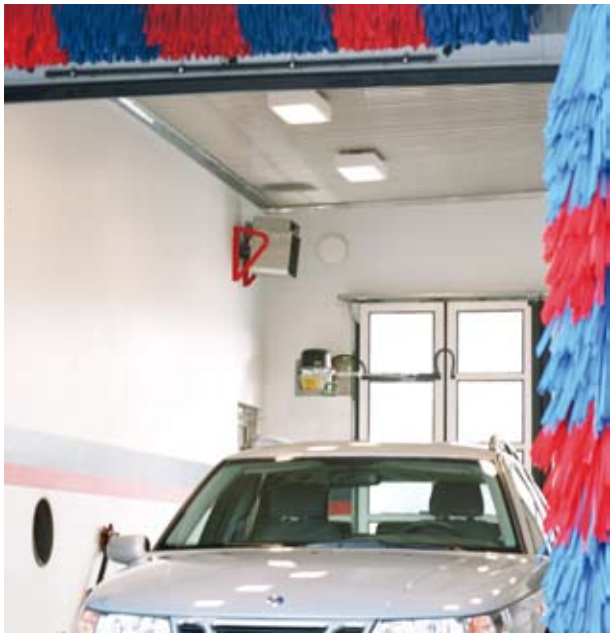
Frico's fan heaters have a long life and providing fast and effective heating at a low cost. Simple installation and a minimum of maintenance also reduce costs and the risk of faults.

Design

The Elektra fan heater has a modern design with a stainless steel outer casing, red grille and red brackets. The brackets can be rotated, which means Elektra can also be used as a portable fan heater.

Product specifications

- The Elektra fan heater is available in four designs:
  - **Elektra C** is intended for corrosive and damp environments, for example, car-wash halls and sewage works. Outer casing of acid-proof sheet steel. IP65.
  - **Elektra F** has a low element temperature and is approved for use in combustible areas, for example, joinery workshops and agricultural buildings. IP65.
  - **Elektra V** is designed to withstand vibrations on ships and offshore platforms and is approved by Det Norske Veritas. Also available for 440V/60Hz. IP44.
  - **Elektra H** is designed for rooms with high temperatures, up to 70 °C. IP44.
- For stationary use. Portable use is possible due to the reversible brackets and fitted carrying handle.
- Stainless steel outer casing (Elektra C has an acid-proof outer casing). Grille and bracket: RAL 3020 (red).



The Elektra C fan heater can also be used in very damp environments such as car-wash halls due to the high IP class and outer casing of acid-proof sheet steel.

Designed for combustible areas — Elektra F fan heater can be the ideal solution for joinery workshops.

Elektra H fan heater has been especially designed for areas with high temperatures, right up to 70 °C.

Vibrations onboard ships and offshore platforms can cause electronic equipment to malfunction. Elektra V fan heater has been designed to overcome these stresses.

Technical specifications | Elektra C. For corrosive environments

Type	Output steps [kW]	Airflow [m³/h]	Sound level [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage*3 [A]	HxWxD [mm]	Weight [kg]
ELC331	0/1,5/3	400	48	21	230V~	9/13,5	375x300x340	13
ELC633	0/3/6	1000	55	17	400V3~	4,5/8,9	445x375x430	20
ELC933	0/4,5/9	1000	55	25	230V3~	6,7/13,2	445x375x430	20
ELC1533	0/7,5/15	1300	63	32	400V3~	11,2/22	445x375x430	20

Technical specifications | Elektra F. For rooms where there is a risk of fire

Type	Output steps [kW]	Airflow [m³/h]	Sound level [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage*3 [A]	HxWxD [mm]	Weight [kg]
ELF331	0/1,5/3	400	48	21	230V~	7/13,5	375x300x340	13
ELF633	0/3/6	700	53	24	400V3~	4,8/9,1	375x300x340	13
ELF933	0/4,5/9	1000	55	25	400V3~	6,7/13,2	445x375x430	20

Technical specifications | Elektra V. For use on ships and within the offshore industry

Type	Output steps [kW]	Airflow [m³/h]	Sound level [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage*3 [A]	HxWxD [mm]	Weight [kg]
ELV331	0/2/3	400	48	21	230V~	9/13,5	375x300x340	13
ELV3333	0/1,5/3	400	48	21	400V3~	4,2/4,9	375x300x340	13
ELV3344	0/1,8/3,6	400	48	21	440/440V3~	4,7/5,3	375x300x340	13
ELV5333	0/2,5/5	700	53	17	400V3~	6,8/7,8	375x300x340	13
ELV6344	0/3/6	700	53	17	400/440V3~	7,4/8,5	375x300x340	13

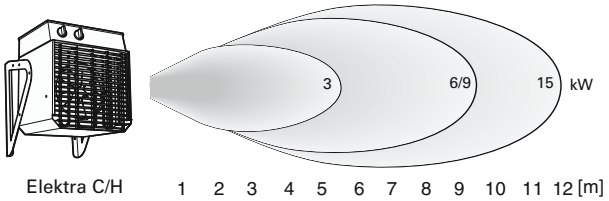
Technical specifications | Elektra H. For rooms with high temperatures

Type	Output steps [kW]	Airflow [m³/h]	Sound level [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage*3 [A]	HxWxD [mm]	Weight [kg]
ELH633	0/3/6	1000	55	24	400V3N~	4,5/8,9	445x375x430	20
ELH933	0/4,5/9	1000	55	25	400V3N~	6,7/13,2	445x375x430	20

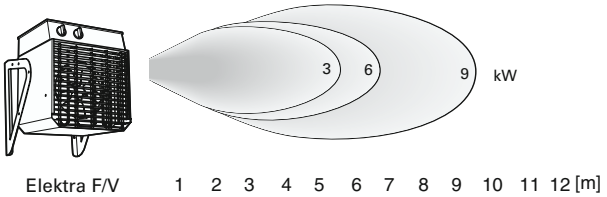
*1) Conditions: Distance to the unit 5 metres.
*2) Δt = temperature rise of passing air at full heat output.
*3) Amperage at half/full output.

Protection class Elektra C/F: IP65, Elektra V/H: IP44.
Approved by SEMKO and CE compliant.
Elektra V is approved by Det Norske Veritas. Elektra F is approved for use in combustible areas.

Air throw



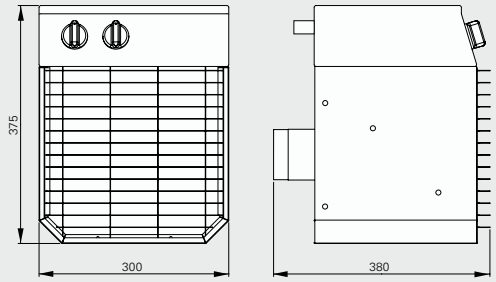
Elektra C/H



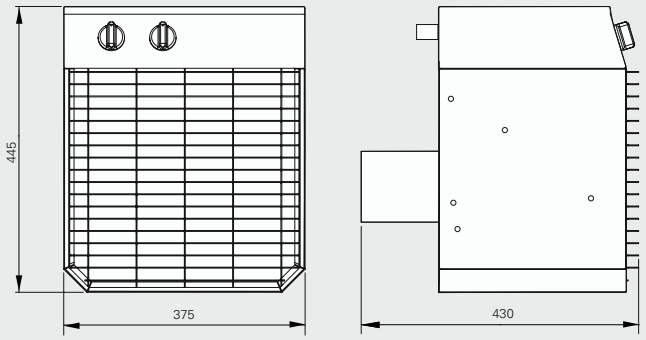
Elektra F/V

Dimensions

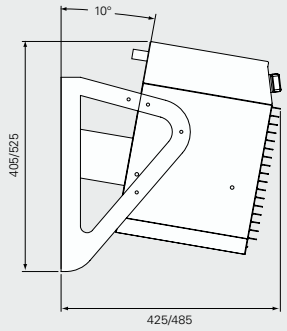
ELC331, ELF331, ELF633, ELV



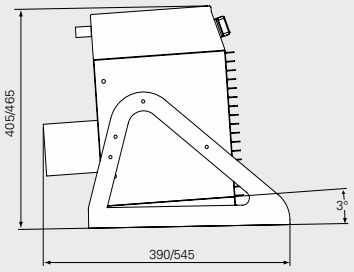
ELC633, ELC933, ELC1533, ELF933, ELH



Fixed installation



Portabel use



Mounting and connection

Mounting

Fan heater Elektra is fitted on the wall and has a fixed tilt angle, 10° down, which gives optimal comfort. Elektra can also be used as a portable fan heater. Wall brackets are supplied and are turned downwards for portable use, see the dimension diagrams. There is a carrying handle at the rear of the unit which facilitates handling. For minimum dimensions with permanent installation, see diagrams 1 and 2.

Electrical installation

The Elektra fan heater is equipped with a 1.8 metre long cable. Elektra F has a CEE plug fitted to the connection cable. The cable glands at the rear of the unit are used to connect accessories.

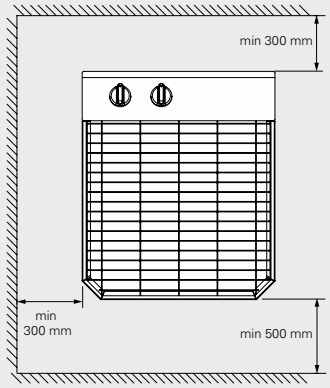


Figure 1: Minimum mounting distance for Elektra C, V and H as well as for Elektra F when ELS (accessory) is not used.

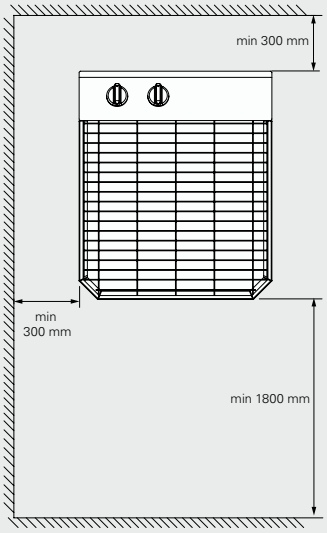


Figure 2: Minimum mounting distance for Elektra F when control panel ELS (accessory) is used.

Control options

Fan heater Elektra H features an integrated thermostat with the working range 0 – +70 °C, other models feature an integrated thermostat with the working range 0 – +35 °C. The output can be selected using the output selector on the unit or on the external control panel.

Elektra C
Can be regulated using an external control panel with integrated thermostat (0 - +35 °C) for remote control, for example, when installed high on a wall.

- ELSRT, control panel, controls one unit
- ELSRT4, control panel, controls up to four units

Elektra F
Can be started/stopped using an external control panel for remote control, for example, when installed high on a wall.

- ELS, control panel

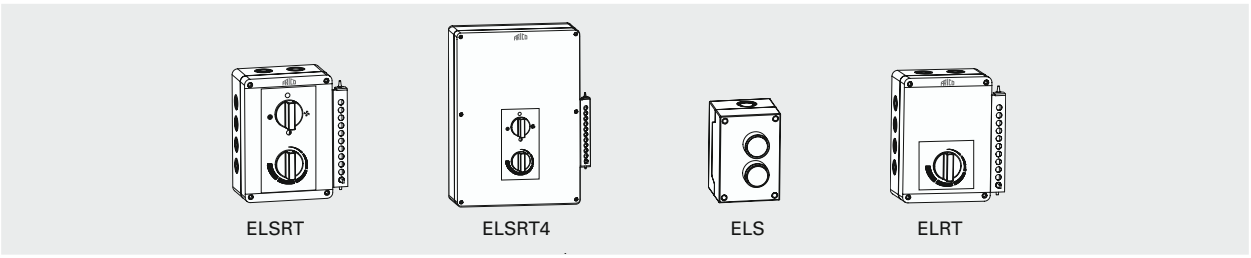
Elektra H
Can be regulated using an external thermostat.

- ELRT, room thermostat

Elektra V
Can be regulated using an external control panel with integrated thermostat (0 - 35 °C) for remote control, for example, when installed high on a wall.

- ELSRT, control panel, controls one unit
- ELSRT4, control panel, controls up to four units

Accessories



ELSRT/ELSRT4, control panel
The required output and temperature can be set on the control panel. Integrated thermostat, +5 – +35 °C. Used for external control, for example, when installed high on a wall. **ELSRT** controls only one unit. **ELSRT4** can control up to four units. IP65.

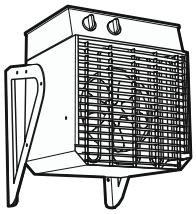
ELS, control panel start/stop
Control panel that starts/stops the fan, for external control, for example, when installed high on a wall. Only one unit can be controlled from one control panel. IP65.

ELRT, room thermostat
Capillary tube thermostat with visible dial. Setting range 0 - +70 °C. Max. breaking current: 16 A. IP44.

Type	Description	HxWxD [mm]
ELSRT	Control panel and thermostat, for ELC/ELV, controls one fan heater	175x150x100
ELSRT4	Control panel and thermostat, for ELC/ELV, controls 4 fan heaters	255x360x110
ELS	Control panel, for ELF, start/stop	105x70x80
ELRT	Thermostat, for ELH	175x150x100

Wiring diagrams

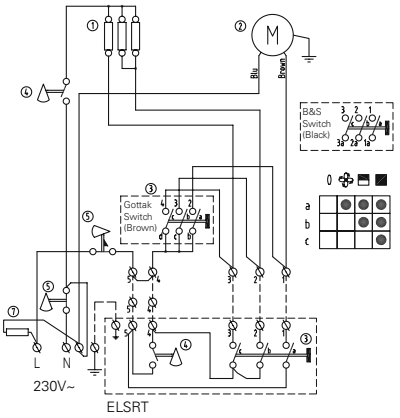
Elektra C



ELSRT,
control box with
thermostat

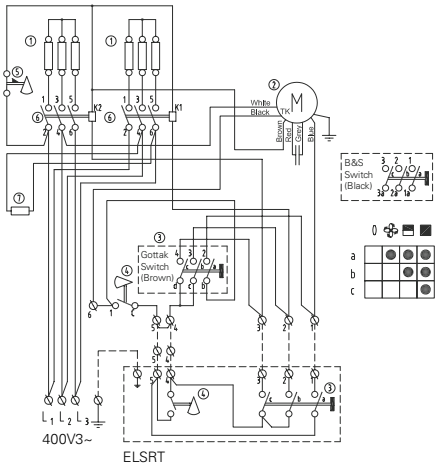
Elektra C 230V~

ELC331



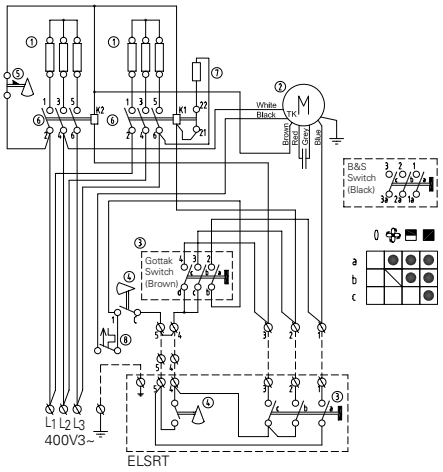
Elektra C 400V3~

ELC633, ELC933

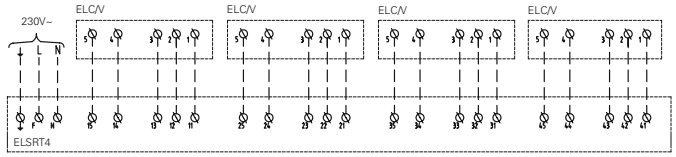


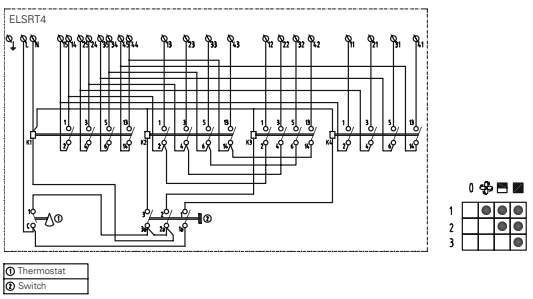
Elektra C 400V3~

ELC1533



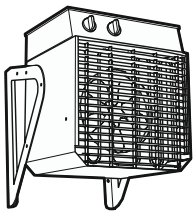
ELSRT4,
control box with thermostat,
for 4 units

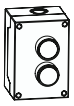




Wiring diagrams

Elektra F

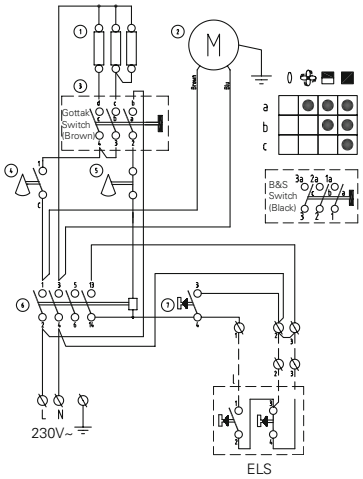




ELS,
control box start/stop

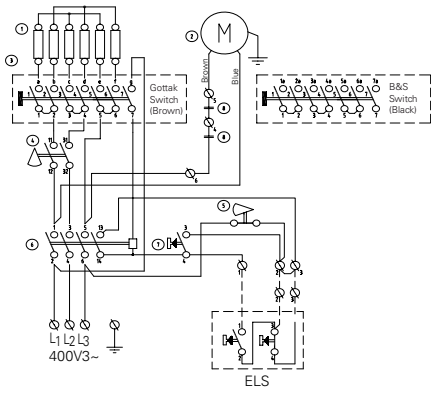
Elektra F 230V~

ELF331



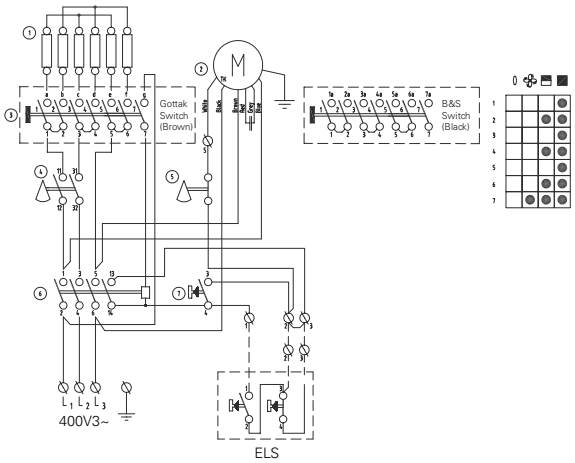
Elektra F 400V3~

ELF633



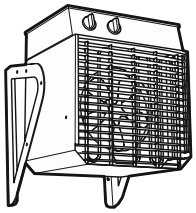
Elektra F 400V3~

ELF933



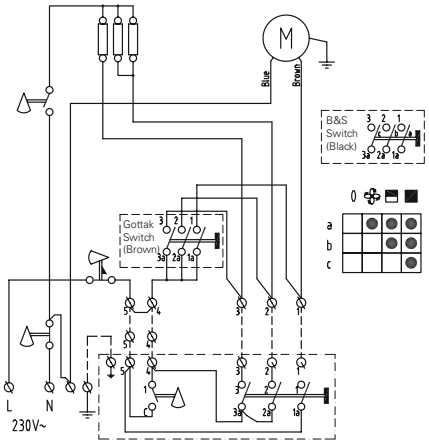
Wiring diagrams

Elektra V



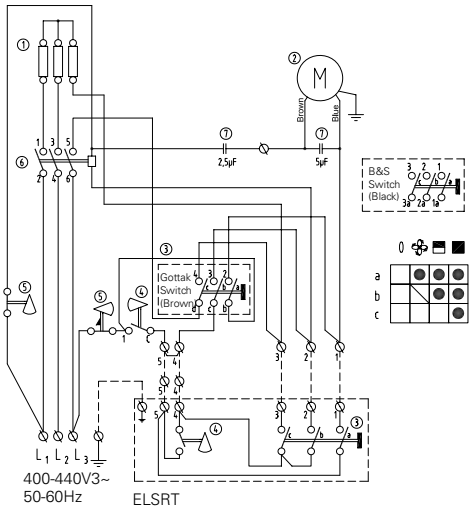
ELSRT,
control box with
thermostat

Elektra V
ELV331



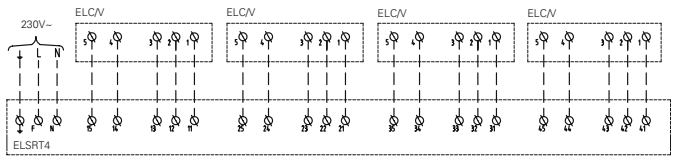
ELSRT

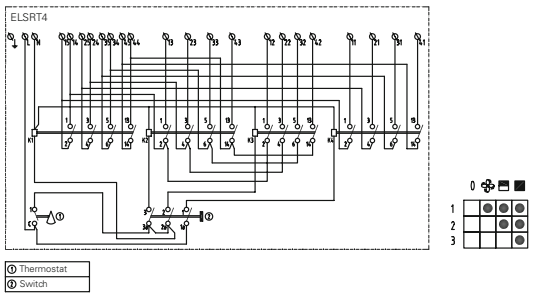
Elektra V 400-440V3~
ELV3333, ELV5333
ELV3344, ELV6344



ELSRT

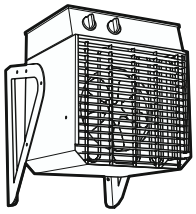
ELSRT4,
control box with
thermostat, for 4 units

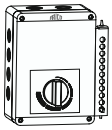




Wiring diagrams

Elektra H

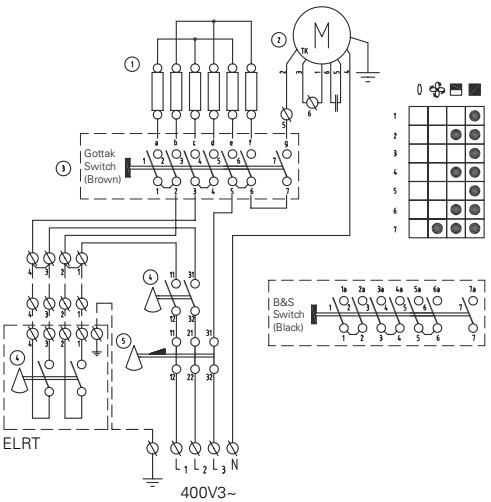




ELRT,
Room thermostat

Elektra H 400V3~

ELH633, ELH933



3–9 kW Electrical heat

3 models

CE

Fan heater Cat

Compact fan heater for smaller premises

Application

Cat is a range of compact and quiet fan heaters for stationary use. It is ideally suited for small stockrooms, in a garage, workshop or shop.The mixing cabinet (accessory) allows heating and ventilation to be combined, through mixing the return air and outdoor air.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. With the wall bracket fitted the Cat fan heater has a tilt angle that provides balanced and good heat distribution.

Operation and economy

Frico's fan heaters have a long life and providing fast and effective heating at a low cost. Simple installation and a minimum of maintenance also reduce costs and the risk of faults.

Design

The Cat fan heater has a classic clean design in white enamelled sheet steel. It is small and unobtrusive and with that easy to position.

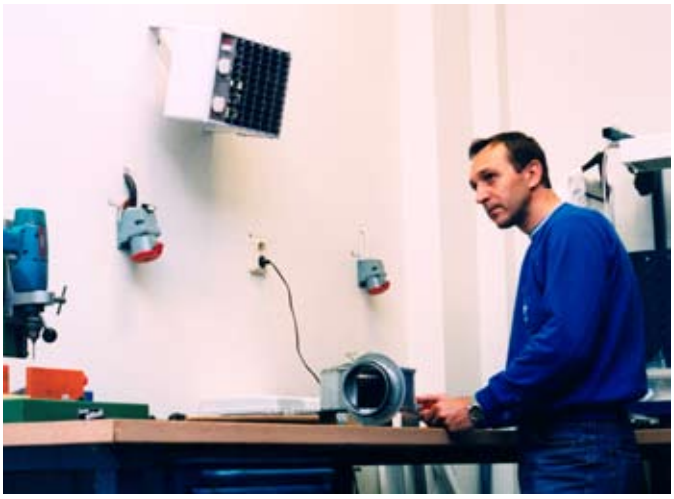
Product specifications

- Low sound level.
- Wall bracket with 10° tilt angle for good heat distribution.
- Cat 3 kW can also be connected to single phase (230V~).
- Integrated thermostat with setting range +5 – +35 °C and output selector. External control, for example, thermostat and timer is possible.
- Mixing cabinet, that combines heating and ventilation, available as an accessory for Cat 3 and 5 kW.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels.
  Colour: RAL 9016, NCS 0500 (white).

The Cat fan heater with mixing cabinet can easily solve problems in premises with negative pressure. Cold air is taken in from below and then heated before being released out into the premises.

A small Cat that is discreet and silent!

Premises that are only used occasionally can be quickly heated when required with a fan heater.



Cat is equipped with a mounted wall bracket that gives the heating fan a tilt angle of 10° for good heat distribution.

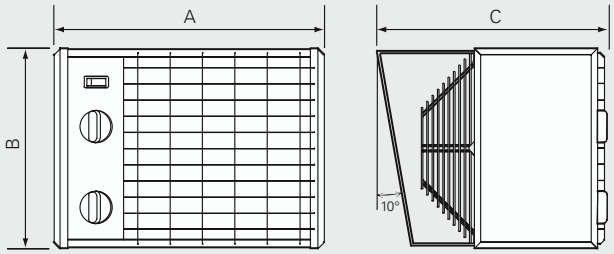
Technical specifications | Fan Heater Cat

Type	Output steps [kW]	Airflow [m³/h]	Sound level*¹ [dB(A)]	Δt*² [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
C3	0/1.5/3	280	41	32	230V~/400V3N~*³	13.2/4.4	255x335x276	6.3
C5	0/2.5/5	480	40	31	400V3N~	7.3	255x335x276	6.7
C9	0/4.5/9	720	44	37	400V3N~	13.1	315x405x335	10.2

*¹) Conditions: Distance to the unit: 3 metres. Directional factor: 2. Equivalent absorption area: 200 m².
*²) Δt = temperature rise of passing air at maximum heat output.
*³) C3 can be connected for 230V~ and 400V3N~. Other models should not be connected for single phase, 230V~.

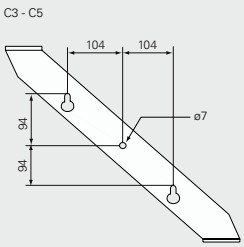
Protection class: IP44.
CE compliant.

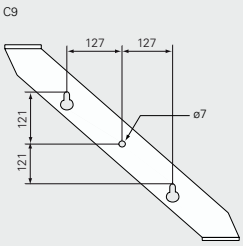
Dimensions



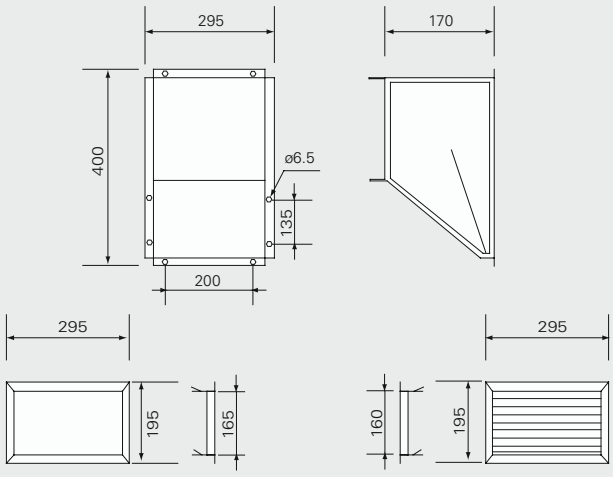
	A [mm]	B [mm]	C [mm]
C3	335	255	276
C5	335	255	276
C9	405	315	335

Bracket

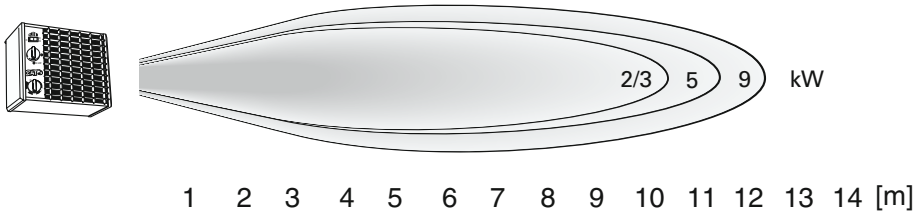




Mixing cabinet (accessory)



Air throw



Mounting and connection

Mounting

The Cat fan heater is mounted on a wall and has a fixed tilt angle, 10° downwards, which gives balanced and good heat distribution. For minimum dimensions with permanent installation, see diagram 1.

Installation with mixing cabinet

Mixing cabinet CMB35 fits C3 and C5. The mixing cabinet is available as an accessory and consists of an outer wall grille, a walling-in frame and a hand controller. The walling-in frame and outer wall grille are built or screwed to the wall. The mixing cabinet and the unit are then fitted. See diagram 2. The control lever consists of a fixture arm, a wall fixture, a ball and two adherent joints. A pull-rod is used between the joints (not included).

Electrical installation

The Cat fan heater is intended for permanent installation. The knockouts at the rear of the unit are used to connect accessories. C3 can also be connected to single phase (230V~).

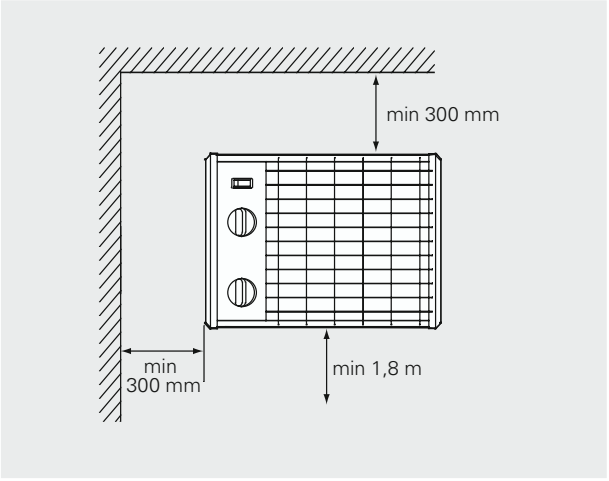


Fig. 1: Minimum distance for fixed installation.

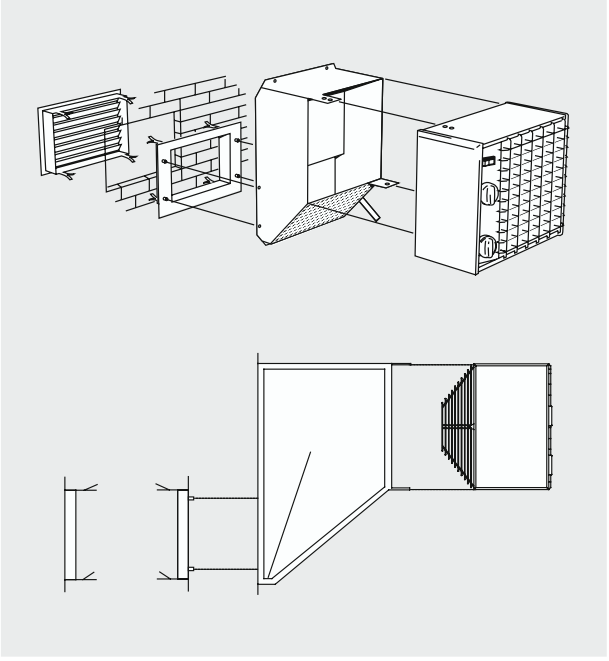


Fig. 2: Cutaway view and side view of Cat with mixing cabinet.

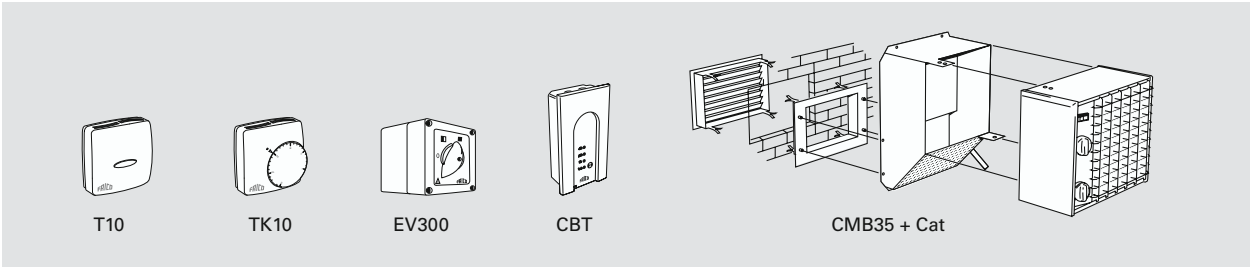
Control options

Integrated regulation
The integrated thermostat controls both the fan and heating, alternatively only the heating. The selection is made using the function selector. In operations with only heating the fan blows continuously and the thermostat only controls the heating output. The thermostat's working range is +5 – +35 °C. The output can be selected using the output selector.

External control
Cat can also be controlled via external output selector, thermostat and timer.

- T10/TK10, electronic thermostat with concealed/ visible knob
- EV300, output selector
- CBT, electronic timer

Controls and accessories



T10/TK10, thermostats
Processor controlled thermostats with concealed and visible dials. Setting range +5 – +30 °C. Connection voltage: 230 V. Max. breaking current: 10 A. IP30.

EV300, output selector
Output selector with output steps 0-1/2-1/1. IP44.

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.

CMB35, mixing cabinet
Mixing cabinet for C3 and C5. Save energy by mixing the outdoor air with the return air in individually selected proportions. An outer wall grille, a walling-in frame and a hand controller are supplied with the mixing cabinet. Read more under "Mounting and connection".

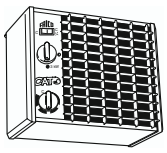
TP3/5 and TP9, cover panel for switches
Covers the switches on the heater and prevents changes in the settings.

For further options, see section on thermostats and controls or contact Frico.

Type	Description	HxWxD [mm]
T10	Electronic thermostat with concealed knob	80x80x31
TK10	Electronic thermostat with visible knob	80x80x31
EV300	Output selector	100x80x90
CBT	Electronic timer	155x87x43
CMB35	Mixing cabinet for C3 and C5	400x295x170
TP3/5	Cover panel for switches - for C3 and C5	
TP9	Cover panel for switches - for C9	

Wiring diagrams

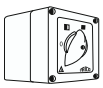
Internal wiring diagram. External control.



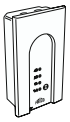
Cat

T10,
electronic thermostat

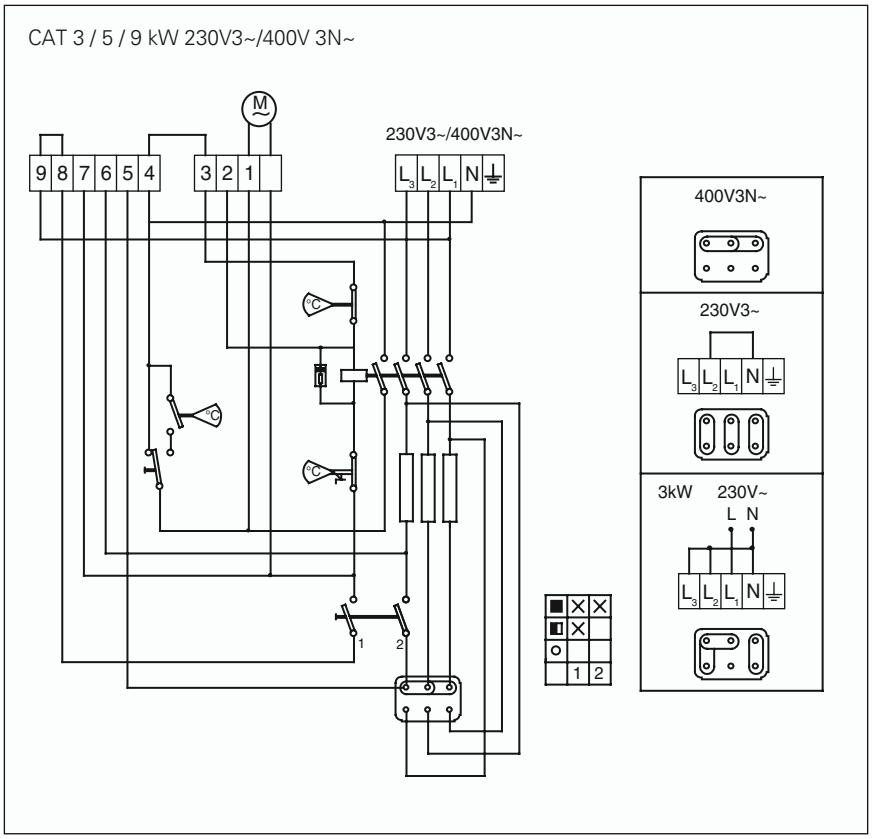
TK10,
electronic thermostat
with knob

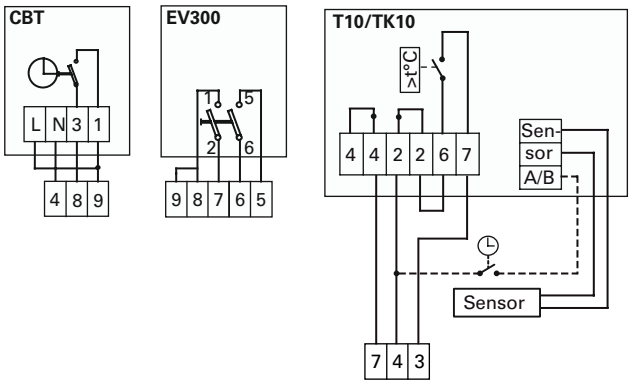


EV300,
output selector



CBT,
electronic timer





6–15 kW Electrical heat

5 models

CE

Fan heater Panther 6-15

Efficient fan heater for medium size premises

Application

Panther 6-15 is a range of very quiet and efficient fan heaters for stationary use. They are intended for heating, drying and ventilation in e.g. workshops, sport halls, shops, assembly rooms and drying rooms. The mixing cabinet (accessory) allows heating and ventilation to be combined, through mixing the return air and outdoor air.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. Fan heater Panther is delivered with adjustable wall mounting brackets which makes it possible to direct the airflow where it is required.

Operation and economy

Frico's fan heaters have a long life and providing fast and effective heating at a low cost. Simple installation and a minimum of maintenance also reduce costs and the risk of faults.

Design

The Panther fan heater has a classic clean design in white enamelled sheet steel.

Product specifications

- Low sound level.
- Supplied with wall bracket that makes it possible to direct the airflow down and to the side.
- SE135 can be connected to both 440V3~and 500V3~.
- Time delay between the output steps.
- Integrated thermostat with setting range +5 – +35 °C, possibility to connect an external thermostat.
- Wide range of controls and accessories.
- External control panel PP15 (ordered separately) with master/slave function, for up to six units gives good and simple control.
- Mixing cabinet, that combines heating and ventilation, is available as an accessory.
- The Panther fan heater is also available in outputs 20-30 kW, see the separate chapter.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels.
  Colour: RAL 9016, NCS 0500 (white).

Panther is delivered with adjustable wall mounting brackets which make it possible to direct the air flow for optimal heat distribution.

Mixing cabinets, available as an accessory, combine heating and ventilation. The mixing cabinet saves energy by mixing return air with fresh air in individually preset proportions.

Fan heaters are usually the least expensive option to permanently heat premises. They give a very high output per invested pound (W/£) and at the same time are easy to install. The Panther fan heater is the perfect choice to heat stores.

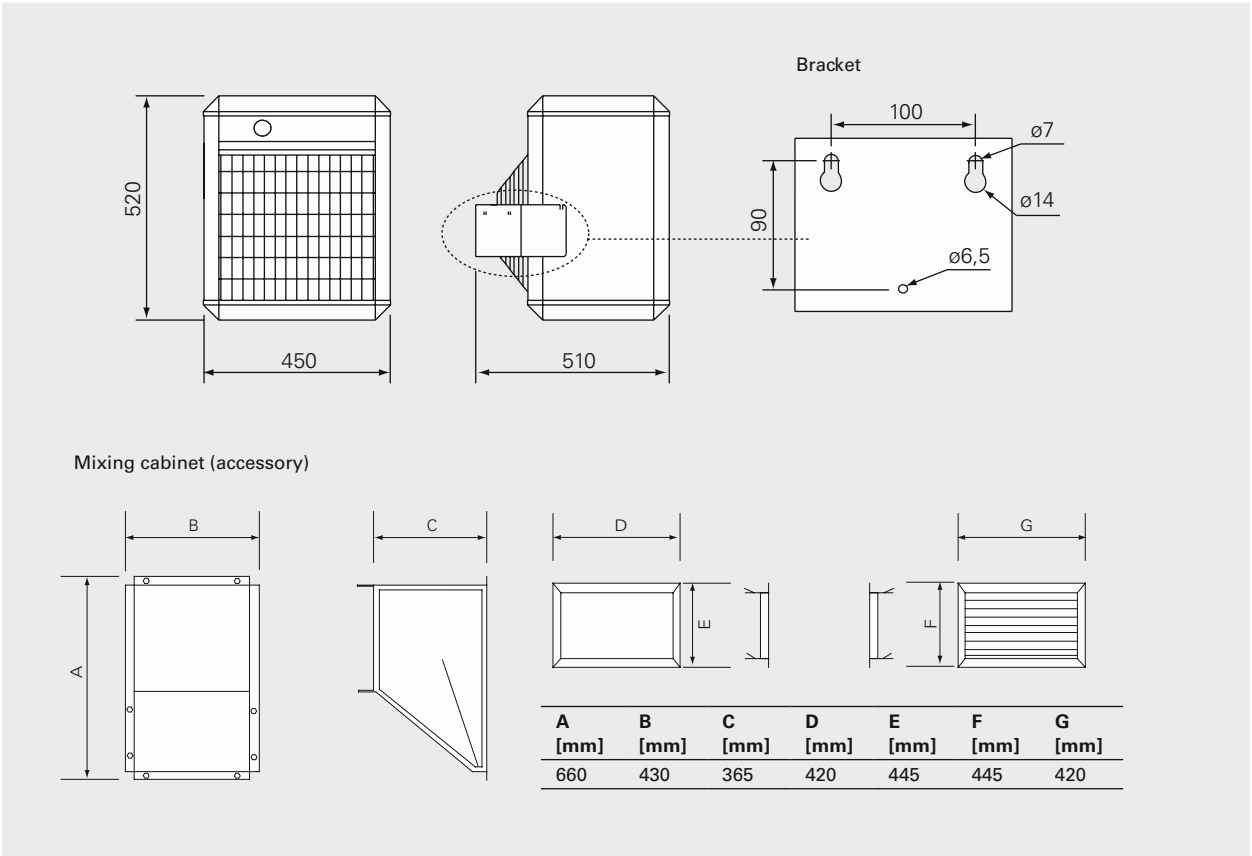
Technical specifications | Fan Heater Panther 6-15 kW

Type	Output steps [kW]	Airflow [m³/h]	Sound level*1 [dB(A)]	Δt*2 [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
SE06	0/3/6	900/1300	39/47	20/14	400V3N~	8.7	520x450x510	21
SE09	0/4.5/9	900/1300	39/47	30/21	400V3N~	13	520x450x510	22
SE12	0/6/12	900/1300	39/47	40/28	400V3N~	17.3	520x450x510	22
SE15	0/7.5/15	900/1300	39/47	50/35	400V3N~	21.7	520x450x510	22
SE135 (convertible)	0/5/10 0/7/13.5	900/1300	39/47	34/23 45/31	440V3~*3 500V3~	13.4 15.6	520x450x510	23

*1) Conditions: Distance to the unit 3 metres. Directional factor: 2. Equivalent absorption area: 200 m².
*2) Δt = temperature rise of passing air at maximum heat output at lowest/highest airflow.
*3) Can be connected to 440V3~ and 500V3~.

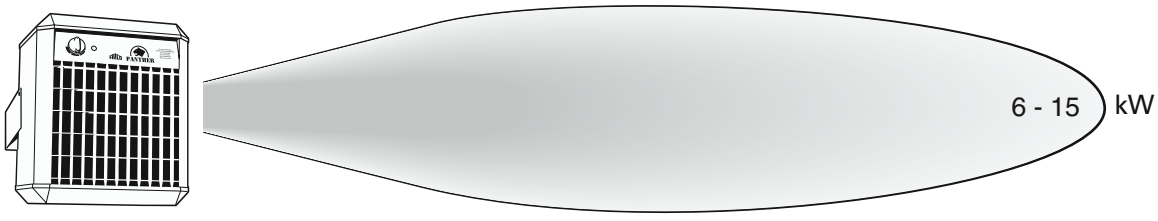
Protection class: IP44.
CE compliant.

Dimensions



A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]
660	430	365	420	445	445	420

Air throw



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 [m]

Mounting and connection

Mounting
The Panther fan heater is mounted on the wall with a wall bracket making it possible to direct the airflow down and to the side. For minimum dimensions with permanent installation, see diagram 1.

Installation with mixing cabinet
Mixing cabinet PBS is available as an accessory and consists of an outer wall grille and a walling-in frame. The walling-in frame and outer wall grille are built or screwed to the wall. The mixing cabinet and the unit are then fitted. See diagram 2. The hand controller (PHR01, accessory) consists of a lever, a wall bracket, a control ball and two associated joints. A pull-rod is used between the joints (not included).

Electrical installation
The Panther fan heater is intended for permanent installation. Supply voltage is 400V3N~. Panther must be supplemented with control panel PP15. The knockouts at the rear of the unit are used to connect accessories. SE135 can be connected to both 440V3~ and 500V3~.

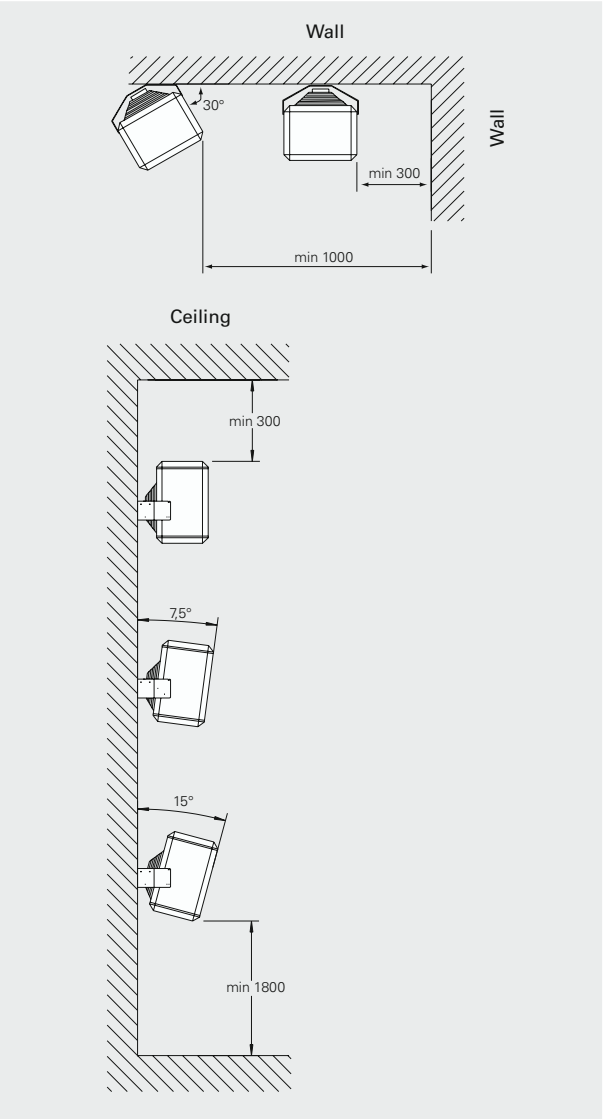


Fig. 1: Minimum distance for fixed installation.

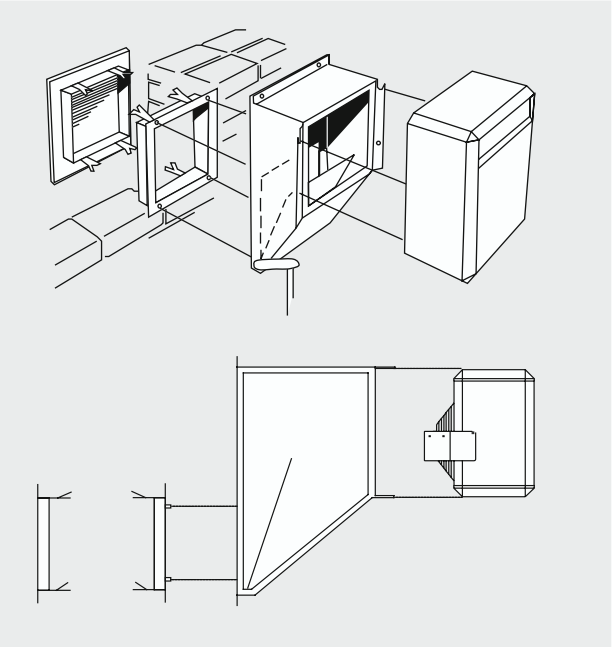


Fig. 2: Cutaway view of Panther with mixing cabinet.

Control options

Fan speed and thermostat control
Panther 6–15 kW is supplied with integrated thermostat (+5 – +35 °C), but can also be controlled using an external two-step thermostat. Selection of the operating mode is done using the external control panel. Delay relays between the output groups prevent simultaneous connection.

- RTI2, electronic 2-step thermostat, IP44
- KRT2800, 2-step capillary tube thermostat, IP55
- PP15, control panel, controls up to six units

Automatic temperature control
The heat can be decreased according to demand, for example at night or weekends. Switches between day and night mode.

- PTA01, automatic temperature control

Control of mixing cabinet
The mixing cabinet combines heating and ventilation by mixing return air with fresh air in appropriate proportions. Damper control is ordered separately.

- PHR01, control lever, manual damper control
- PSA01, automatic damper- and temperature control
- PSM01, damper motor, is used in combination with PSA01 when several mixing cabinets should be controlled.

Controls and accessories

RTI2, electronic 2-step thermostat
Processor controlled 2-step thermostat with concealed dial. Setting range +5 – +35 °C. Connection voltage 230 V (two potential free contacts). Max. breaking current: 16/10 A (230/400 V). IP44.

KRT2800, 2-step capillary tube thermostat
2-step capillary tube thermostat with concealed dial. Setting range 0 – +40 °C. Max. breaking current: 16/10 A (230/400 V). IP55.

PP15, control box
The desired output and fan speed can be set on the control box. Up to 6 units can be controlled by one control box. Protection class: IP44.

PTA01, automatic temperature control
PTA01 can be used to lower the heat when necessary (1–10°C), for example at night or weekends. The control consists of an electronic timer and thermostat with an external sensor. The timer alternates between day and night mode. Protection class: IP55.

PHR01, control lever for mixing cabinet
Used with the mixing cabinet, if you wish to control the damper manually. The pull-rod (not included) for the lever should have a diameter of 8 mm.

PSA01, automatic damper and temperature regulator
Used on the mixing cabinet. Lowers the temperature and reduces the amount of outdoor air during periods with a low requirement. Consists of timer (weekly timer), thermostat with external sensor, potentiometer and damper motor. Exhaust air fans can possibly be controlled from the automatic system. One damper motor (PSM01) included. IP55.

PSM01, damper motor
Used in combination with PSA01 when several mixing cabinets should be controlled. (1 damper motor is included in PSA01.) Protection class: IP54.

For further options, see section on thermostats and controls or contact Frico.

PBS01, mixing cabinet
Saves energy by mixing return air with fresh air in preset proportions. The mixing cabinet is delivered with a wall frame and outer wall grille. Read more under "Mounting and connection".

PLR15, air director
The air director directs the airflow vertically or laterally. PLR is snapped on the front of the heater. Torsional (turning) angle 0–35°.

PFF15, exhaust air fan
Can be used with fan heater/mixing cabinet to obtain good ventilation. Airflow approx. 1400 m³/h. Protection class: IP54.

PTRP, drying room kit
Consists of exhaust air fan TTF140 with flexi hose and connection sleeve, thermostat KRT1900 and timer CBT. The exhaust air fan works alternately with, for example, a fan heater, which gives the shortest possible drying time and minimal energy consumption. Supplemented with a fan heater from the Panther range with output 6-12 kW.

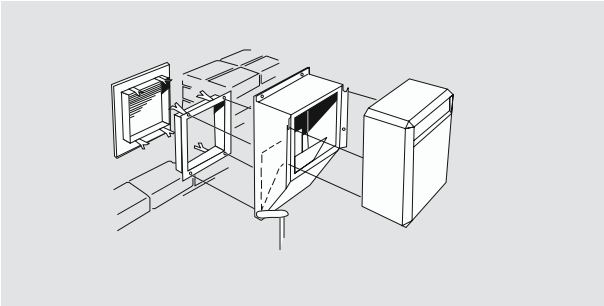


Fig. 3: Mixing cabinet PBS01 with Panther.

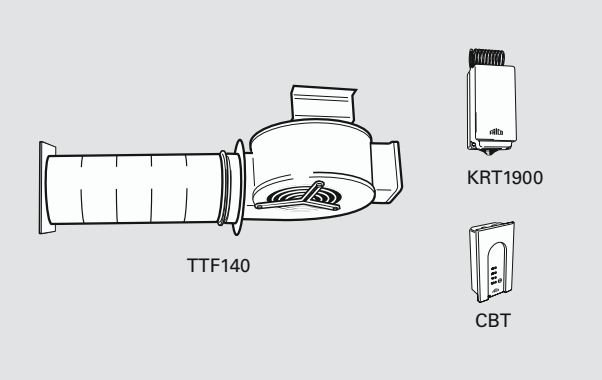
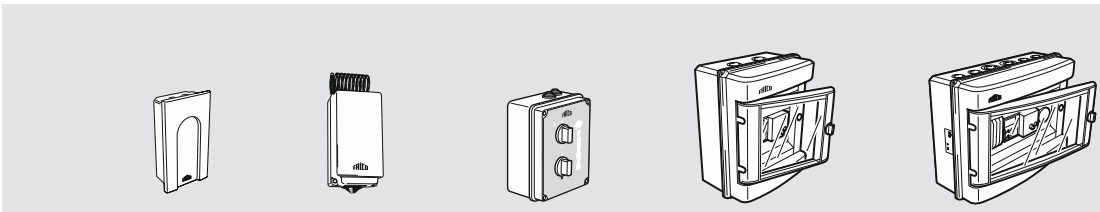


Fig. 4: Drying room kit PTRP.

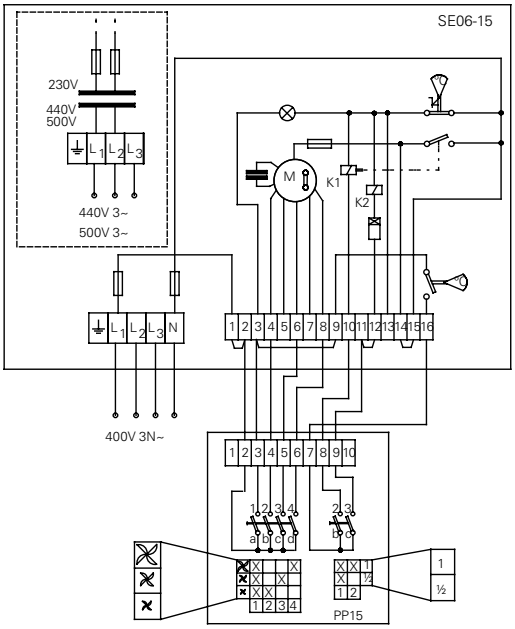


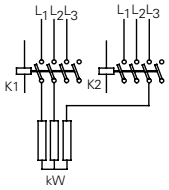
Type	Description	HxWxD [mm]
RTI2	Electronic 2-step thermostat	155x87x43
KRT2800	2-step capillary tube thermostat	165x60x57
PP15	Control box for SE06 – SE15	160x120x96
PTA01	Automatic temperature control	185x215x115
PBS01	Mixing cabinet for SE06 – SE15	660x430x365
PHR01	Control lever	
PSA01	Automatic damper and temperature control	305x215x115
PSM01	Damper motor	180x100x70
PLR15	Air director for SE06 – SE15	355x355x60
PFF15	Exhaust air fan for SE06 – SE15	
PTRP	Drying room kit without fan heater	

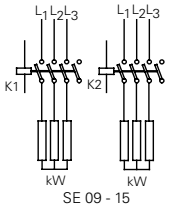
Wiring diagrams

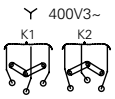
Fan speed and thermostat control

Panther 6-15 kW



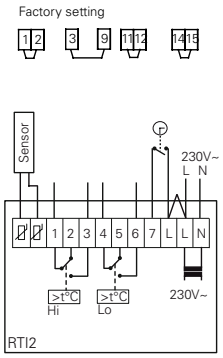


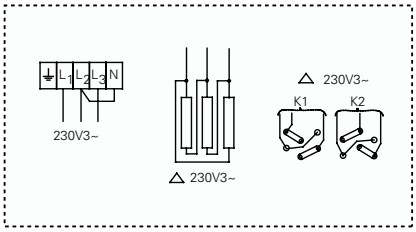


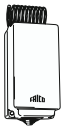


PP15,
control box

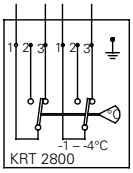
RTI2,
electronic 2-step
thermostat







KRT2800,
2-step thermostat

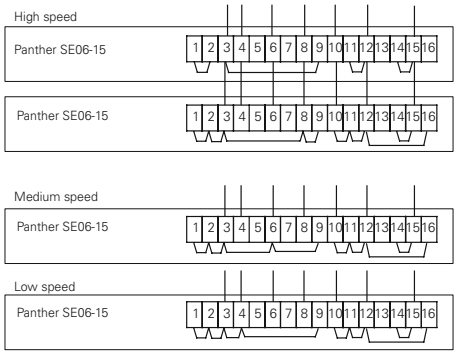


Wiring diagrams

Wiring of accessories to Panther 6-15

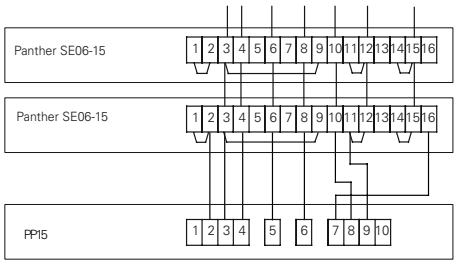
Panther 6-15 kW

Note! Remove the two internal fuses in the slave unit(s).



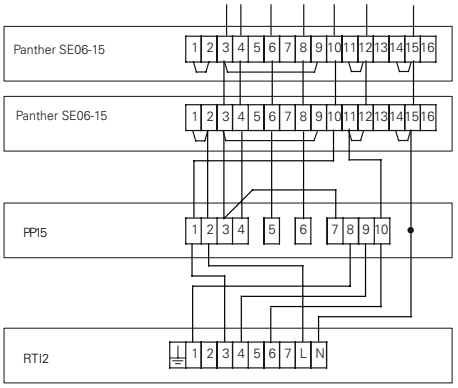
PP15,
control box

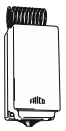
Note! Remove the two internal fuses in the slave unit(s).



RTI2,
electronic 2-step
thermostat

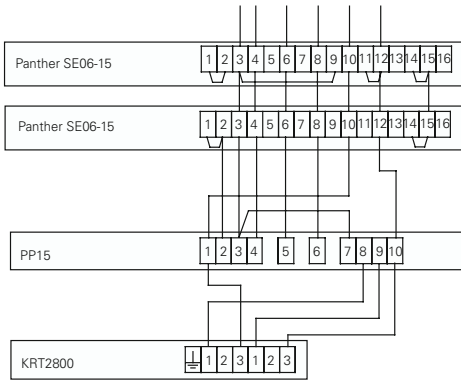
Note! Remove the two internal fuses in the slave unit(s).





KRT2800,
2-step thermostat

Note! Remove the two internal fuses in the slave unit(s).



6–15 kW Electrical heat

5 models

CE

Fan heater Panther 20-30

Powerful fan heater for large premises

Application

Panther 20–30 is a range of powerful and quiet fan heaters for stationary use. They are intended for heating, drying and ventilation of large premises, for example, industries. The mixing cabinet (accessory) allows heating and ventilation to be combined, through mixing the return air and outdoor air.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. Fan heater Panther is delivered with adjustable wall mounting brackets which makes it possible to direct the airflow where it is required.

Operation and economy

Frico's fan heaters have a long life and providing fast and effective heating at a low cost. Simple installation and a minimum of maintenance also reduce costs and the risk of faults.

Design

The Panther fan heater has a classic clean design in white enamelled sheet steel.

Product specifications

- Supplied with wall bracket that makes it possible to direct the airflow down and to the side.
- SE305 can be connected to both 440V3~and 500V3~.
- Time delay between the output steps.
- Post-running thermostat for efficient cooling.
- Wide range of controls and accessories.
- External control panel PP20/30 (ordered separately) with master/slave function, for up to six units, and external thermostat, for example, RTI2 gives good and simple control.
- Mixing cabinet, that combines heating and ventilation, is available as an accessory.
- The fan heater Panther is also available in outputs 6-15 kW, see the separate chapter.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels.
  Colour: RAL 9016, NCS 0500 (white).

The fan heater Panther 20-30 is suitable for heating large industrial premises.

Fan heaters are usually the least expensive option to permanently heat premises The fan heater Panther is a range of powerful and quiet fan heaters that are ideal for both demanding environments as well as premises where there are demands on a low sound level.

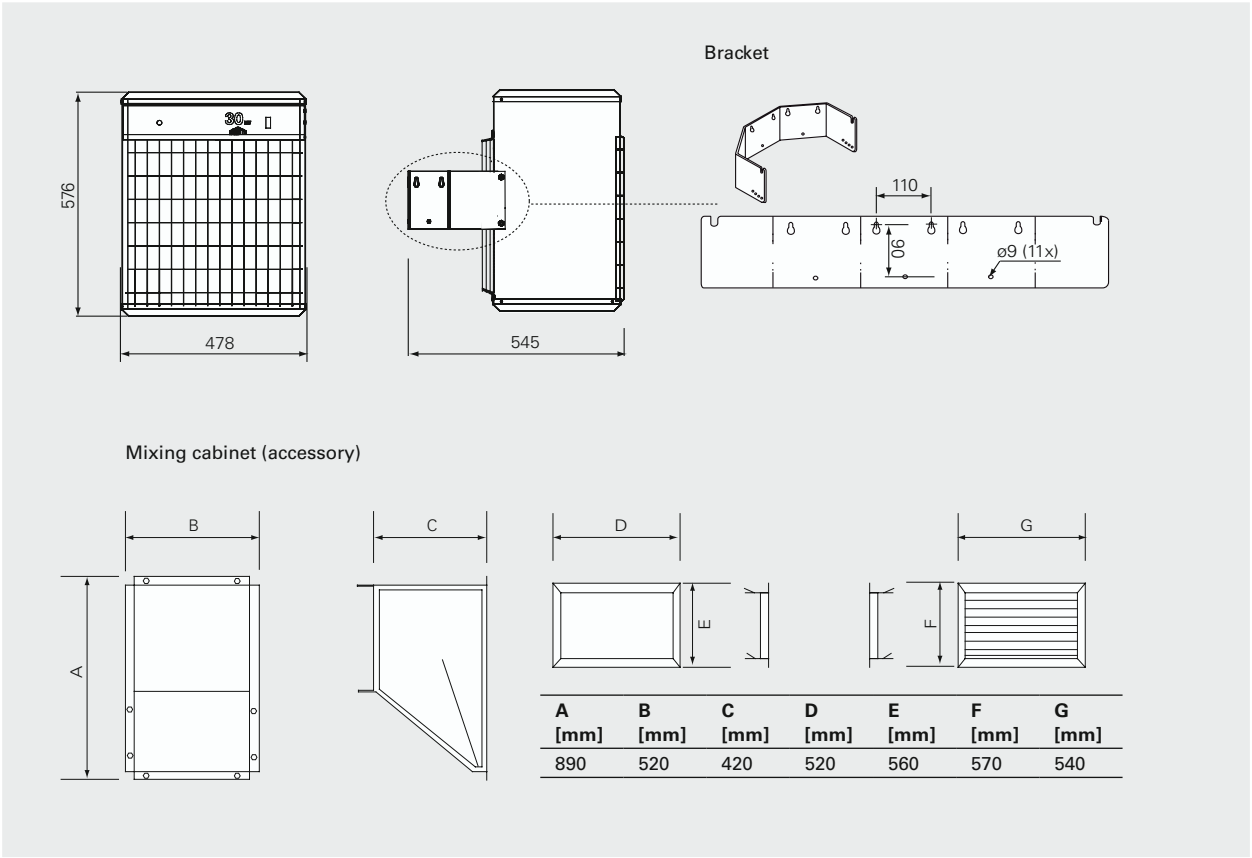
Technical specifications | Fan Heater Panther 20-30 kW

Type	Output steps [kW]	Airflow [m³/h]	Sound level*¹ [dB(A)]	Δt*² [°C]	Voltage [V]	Amperage [A]	HxWxD [mm]	Weight [kg]
SE20	0/10/20	1900/2600	52/60	31/23	400V3N~	29.5	576x478x545	27
SE30	0/10/20/30	1900/2600	52/60	47/34	400V3N~	43.9	576x478x545	31
SE305 (convertible)	0/7.5/15/23	1900/2600	52/60	36/26	440V3N~*³	30.8	576x478x545	32
	0/10/20/30			47/34	500V3N~	35.1		

*¹) Conditions: Distance to the unit 3 metres. Directional factor: 2. Equivalent absorption area: 200 m².
*²) Δt = temperature rise of passing air at maximum heat output at lowest/highest air flow.
*³) Can be connected to 440V3~ and 500V3~.

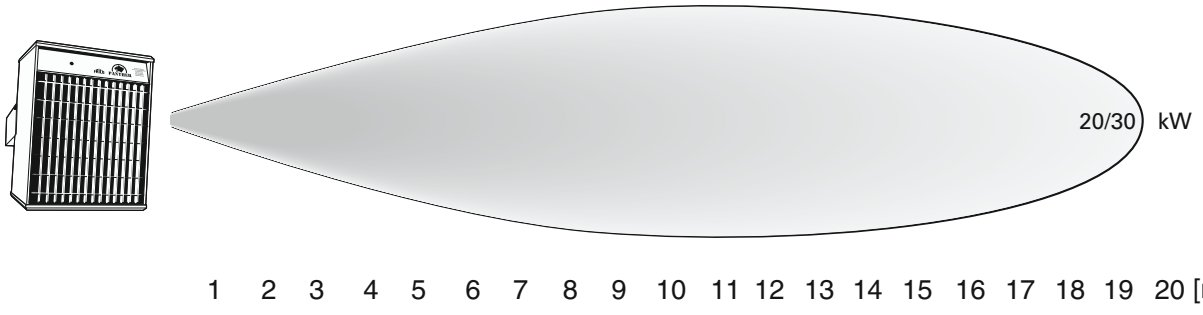
Protection class: IP44.
CE compliant.

Dimensions



A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]
890	520	420	520	560	570	540

Air throw



Mounting and connection

Mounting
The Panther fan heater is mounted on the wall with a wall bracket making it possible to direct the airflow down and to the side. For minimum dimensions with permanent installation, see diagram 1.

Installation with mixing cabinet
Mixing cabinet PBS is available as an accessory and consists of an outer wall grille and a walling-in frame. The walling-in frame and outer wall grille are built or screwed to the wall. The mixing cabinet and the unit are then fitted. See diagram 2. The hand controller (PHR01, accessory) consists of a lever, a wall bracket, a control ball and two associated joints. A pull-rod is used between the joints (not included).

Electrical installation
The fan heater Panther is intended for permanent installation. Panther must be supplemented with control panel PP20/30 and an external thermostat, for example. RTI2. The knockouts at the rear of the unit are used to connect accessories. SE305 can be connected to both 440V3~ and 500V3~.

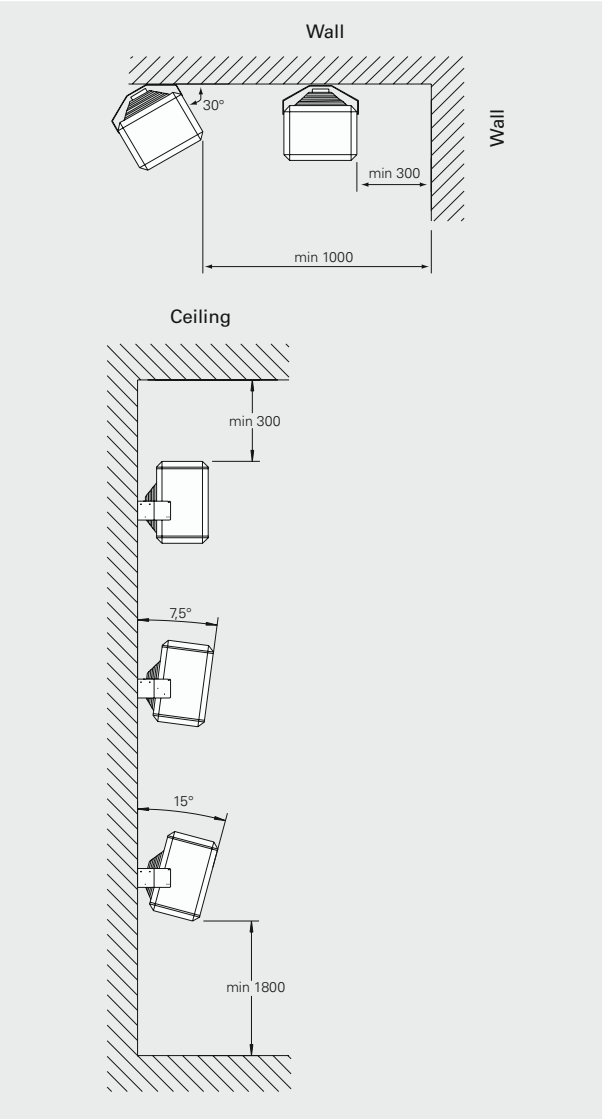


Fig. 1: Minimum distance for fixed installation.

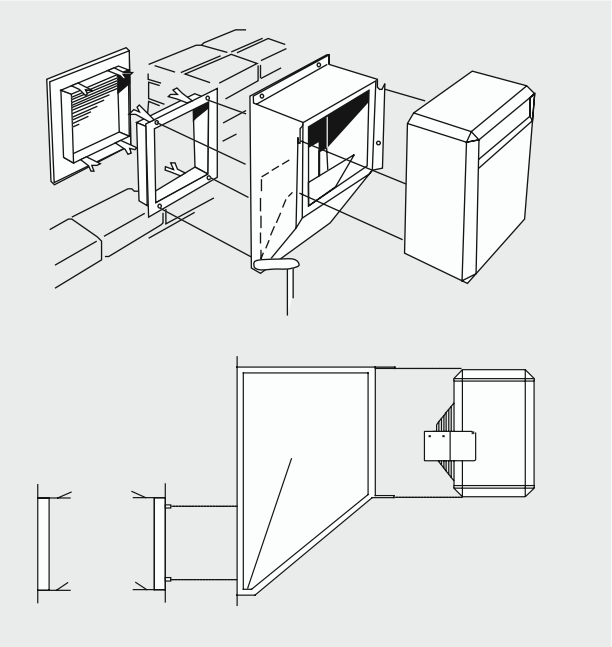


Fig. 2: Cutaway view of Panther with mixing cabinet.

Control options

Fan speed and thermostat control
Panther 20–30 kW is controlled using an external thermostat. Selection of the operating mode is done using the external control panel. Delay relays between the output groups prevent simultaneous connection.

- RTI2, electronic 2-step thermostat, IP44
- KRT2800, 2-step capillary tube thermostat, IP55
- PP20/30, control panel, controls up to six units

Automatic temperature control
The heat can be decreased according to demand, for example at night or weekends. Switches between day and night mode.

- PTA01, automatic temperature control

Control of mixing cabinet
The mixing cabinet combines heating and ventilation by mixing return air with fresh air in appropriate proportions. Damper control is ordered separately.

- PHR01, control lever, manual damper control
- PSA01, automatic damper- and temperature control
- PSM01, damper motor, is used in combination with PSA01 when several mixing cabinets should be controlled.

Controls and accessories

RTI2, electronic 2-step thermostat
Processor controlled 2-step thermostat with concealed dial. Setting range +5 – +35 °C. Connection voltage 230 V (two potential free contacts). Max. breaking current: 16/10 A (230/400 V). IP44.

KRT2800, 2-step capillary tube thermostat
2-step capillary tube thermostat with concealed dial. Setting range 0 – +40 °C. Max. breaking current: 16/10 A (230/400 V). IP55.

PP20/30 control box
The desired output and fan speed can be set on the control box. Up to 6 units can be controlled by one control box. Protection class: IP44.

PTA01, automatic temperature control
PTA01 can be used to lower the heat when necessary (1–10°C), for example at night or weekends. The control consists of an electronic timer and thermostat with an external sensor. The timer alternates between day and night mode. Protection class: IP55.

PHR01, control lever for mixing cabinet
Used with the mixing cabinet, if you wish to control the damper manually. The pull-rod (not included) for the lever should have a diameter of 8 mm.

PSA01, automatic damper and temperature regulator
Used on the mixing cabinet. Lowers the temperature and reduces the amount of outdoor air during periods with a low requirement. Consists of timer (weekly timer), thermostat with external sensor, potentiometer and damper motor. Exhaust air fans can possibly be controlled from the automatic system. One damper motor (PSM01) included. IP55.

PSM01, damper motor
Used in combination with PSA01 when several mixing cabinets should be controlled. (1 damper motor is included in PSA01.) Protection class: IP54.

For further options, see section on thermostats and controls or contact Frico.

PBS02, mixing cabinet
Saves energy by mixing return air with fresh air in preset proportions. The mixing cabinet is delivered with a wall frame and outer wall grille. Read more under "Mounting and connection".

PLR30, air director
The air director directs the airflow vertically or laterally. PLR is snapped on the front of the heater. Torsional (turning) angle 0–35°.

PFF30, exhaust air fan
Can be used with fan heater/mixing cabinet to obtain good ventilation. Airflow approx. 2600 m³/h. Protection class: IP54.

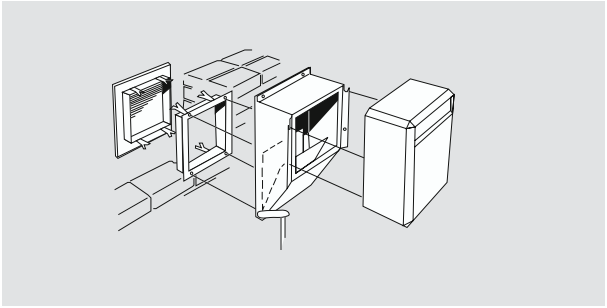
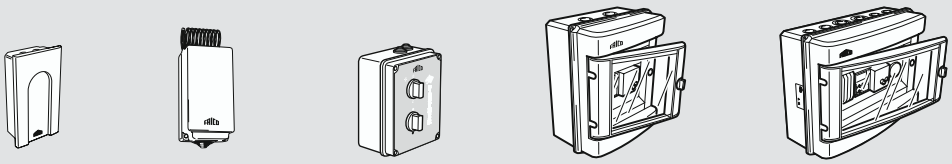


Fig. 3: Mixing cabinet PBS02 with Panther.

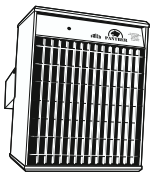


RTI2 KRT2800 PP20/30 PTA01 PSA01

Type	Description	HxWxD [mm]
RTI2	Electronic 2-step thermostat	155x87x43
KRT2800	2-step capillary tube thermostat	165x60x57
PP20	Control box for SE20	160x120x96
PP30	Control box for SE30 and SE305	160x120x96
PTA01	Automatic temperature control	185x215x115
PBS02	Mixing cabinet for SE20, SE30 and SE305	890x520x420
PSA01	Automatic damper and temperature control	305x215x115
PHR01	Control lever	
PSM01	Damper motor	180x100x70
PLR30	Air director for SE20, SE30 and SE305	415x445x60
PFF30	Exhaust air fan for SE20, SE30 and SE305	

Wiring diagrams

Speed and thermostat control. Slave connection of the unit.

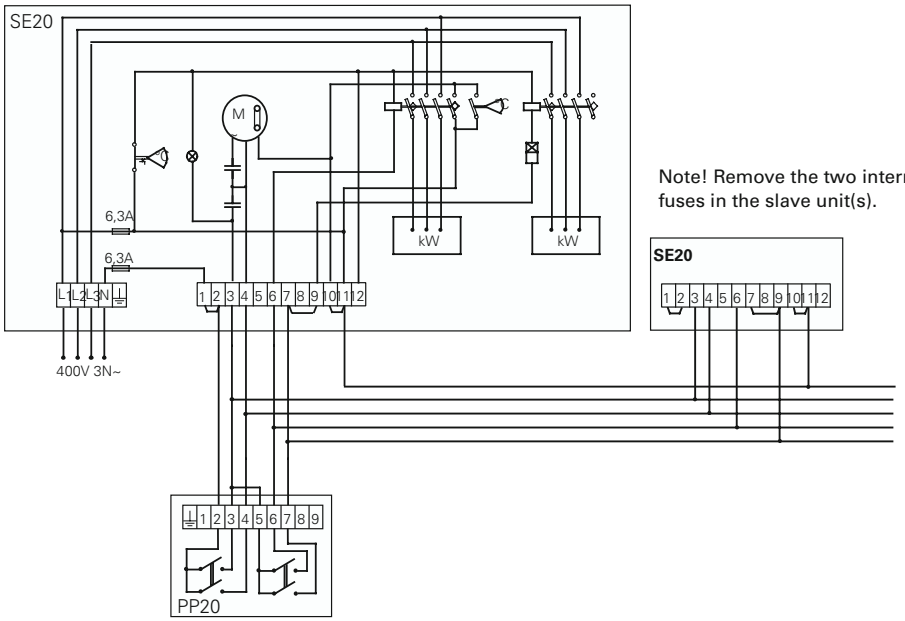


Panther 20 kW

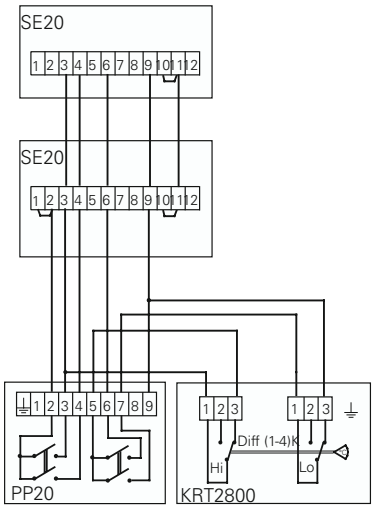
PP20,
control box

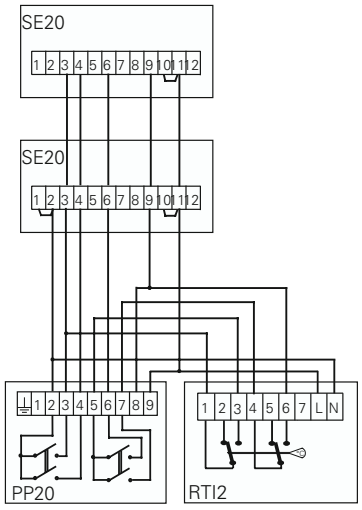
RTI2,
electronic 2-step
thermostat

KRT2800,
2-step thermostat



Note! Remove the two internal fuses in the slave unit(s).





Wiring diagrams

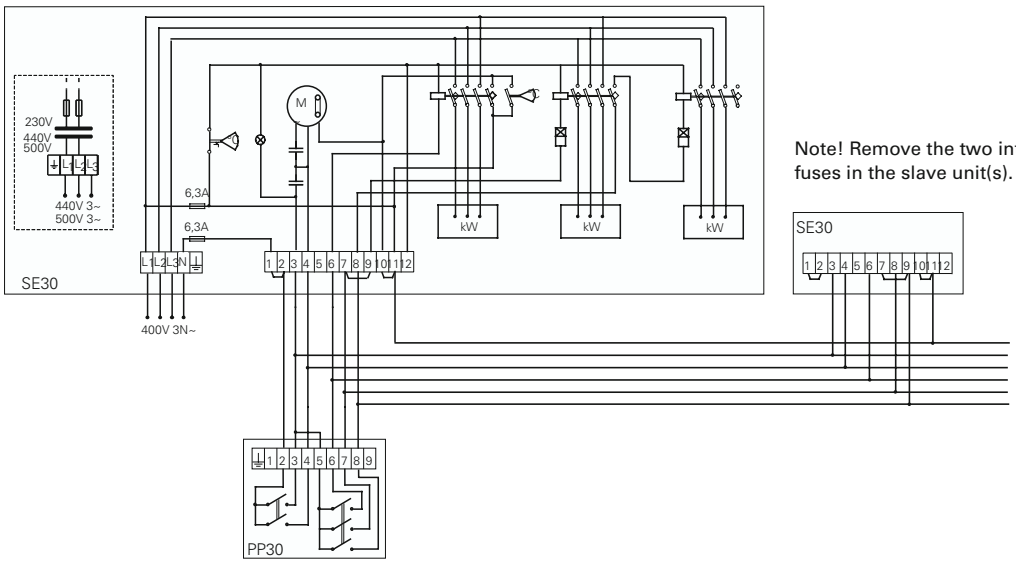
Speed and thermostat control. Slave connection of the unit.

Panther 30 kW

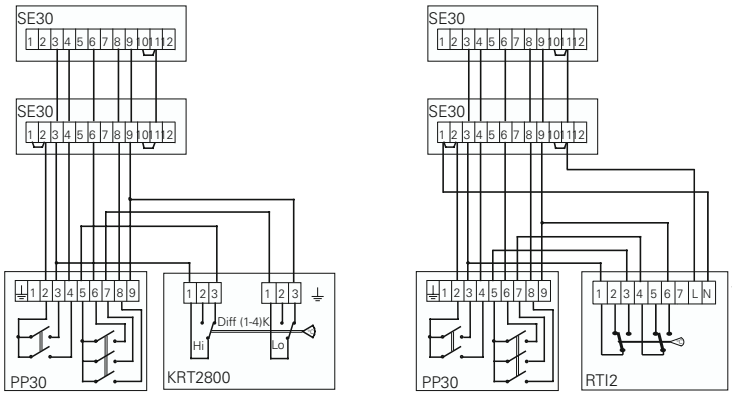
PP30,
control box

RTI2,
electronic 2-step
thermostat

KRT2800,
2-step thermostat



Note! Remove the two internal fuses in the slave unit(s).



3 kW Electrical heat

Length: 0.6 metres

CE

Door heater PA1006

For increased comfort inside the door

Application

PA1006 is a compact door heater which heats the incoming air and gives increased comfort on the inside. When wall mounted, the unit can act as a stationary fan heater.

Comfort

The cold incoming air is heated by the door heater and a good level of comfort heat is obtained inside the door. The bracket included in delivery makes it possible to angle the unit 30° out from the wall, which gives an even heat distribution in the premises.

Operation and economy

The door heater is easy to use and is controlled by a switch located on the unit.

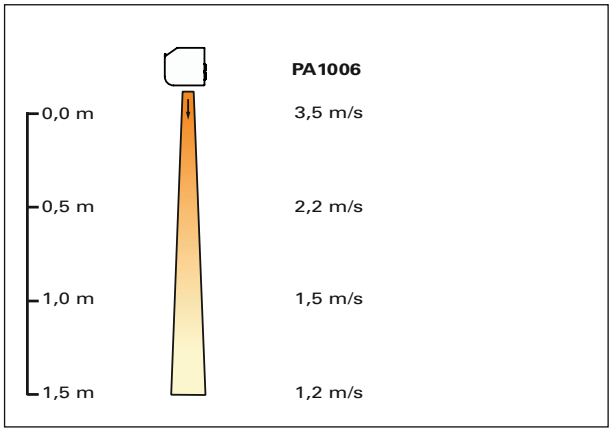
Design

The door heater has a clean, straight forward design. As the air inlet is placed on top of the unit the front of the unit is kept free of dirt and dust.

Product specifications

- Compact and easy to position.
- Low sound level.
- The unit is easily angled on the bracket, which is used for both wall and ceiling mounting.
- Integrated control.
- Corrosion proof housing made of hot zinc-plated and powder lacquered steel panels. Colour front: RAL 9016, NCS 0500 (white). Colour grille, rear section and ends: RAL 9005 (black).

Air velocity profile



Technical specifications | Thermozone PA 1006, door heater

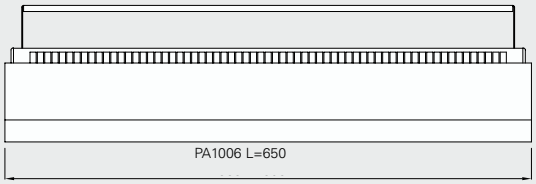
Type	Output [kW]	Airflow [m³/h]	Δt*1 [°C]	Sound level*2 [dB(A)]	Voltage [V]	Amperage [A]	Length [mm]	Weight [kg]
PA1006E03	0/1,5/3	230	39	44	240V~	12,8	650	5,3

*1) Δt = temperature rise of passing air at maximum heat output.
*2) Conditions: Distance to the unit 5 metres. Directional factor: 2. Equivalent absorption area: 200 m².

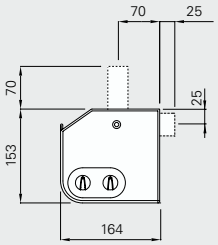
Protection class: IP20.
CE compliant.

Dimensions

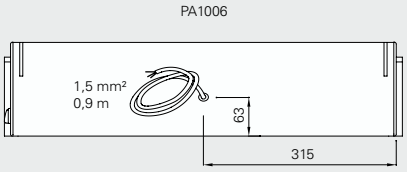
Front



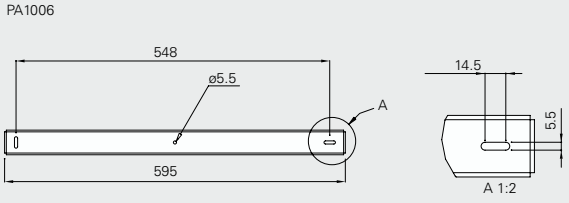
Side



Back



Bracket



Frico AB
031 336 86 00
www.frico.se

Mounting and connection

Mounting

The unit is installed horizontally with the supply air grille facing downwards. Position as close to the opening as possible for the best effect.

The unit can be angled using the enclosed bracket, which is used for both wall and ceiling mounting. When mounted on the wall it is possible to angle the heater up to 30° to give even heat distribution in the room.

Connection

The unit is designed for permanent installation and is connected via cable (1.5 mm², 0.9 m) without plug at the rear of the unit.

Controls

The door heater has an integrated selector for the fan and heating.

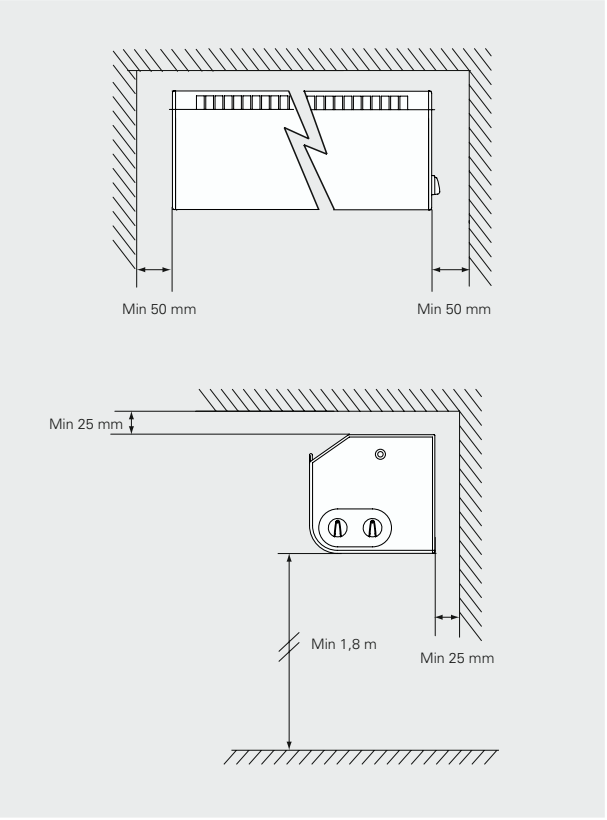
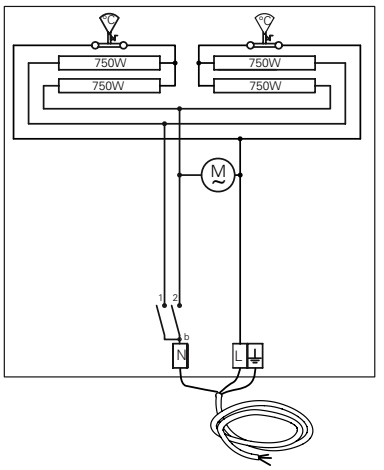


Fig 1. Minimum distances.

Wiring diagrams

PA1006E03



		b	
		1	2
0	OFF	o	
1	+ 1,5kW	◓	○
2	+ 3kW	■	○ ○

Fan heaters - water heated

A fan heater for water connection provides effective heating at a low cost. Fan heaters are robust and reliable and have a long service life. The fact that they are extremely quiet means that these fans are also suitable for use in rooms that require a low noise level.

Compact

SW02 is a compact fan heater with very low sound level designed for water connection. It is ideal for use where fan heaters are traditionally used such as in industrial buildings and warehouses, but also in environments with high demands on low sound levels, for example, stores and assembly halls.

Quiet

The low sound level and attractive design of the SW fan heater makes it ideal for use where fan heaters are traditionally used such as in industrial buildings and warehouses, but also in environments with high demands on low sound levels, for example, stores and assembly halls. The SW fan heater is designed for the connection of water and can be mounted either on the wall or ceiling.

Water heat

1 model

Fan Heater SW02

Quiet fan heater for connection to water in small buildings

Application

SW02 is a compact fan heater with very low sound level designed for water connection. It is ideal for use where fan heaters are traditionally used such as in industrial buildings and warehouses, but also in environments with high demands on low sound levels, for example, stores and assembly halls.

Comfort

Frico's fan heaters are extremely quiet and quickly provide comfortable heating. The SW02 heater fan is equipped with an air director, which has individually adjustable louvres and directs the air flow as required.

Operation and economy

Frico's air fan heaters have a long life, providing fast and effective heating at a low cost. The air flow for SW02 can be controlled in three steps, which gives energy efficient output.

Design

The fan heater has a classic clean design in white enamelled sheet steel.

Product specifications

- Very low sound level.
- Mounted using the enclosed bracket on the wall or ceiling.
- Intended to pump hot water up to +110 °C in the standard design, but available for water temperatures up to +130 °C in special designs.
- Supplied with air director with individually adjustable louvres that direct the air flow on one plane.
- Three fan speeds.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels. Colour: RAL 9016, NCS 0500 (white). Aluminium louvres.

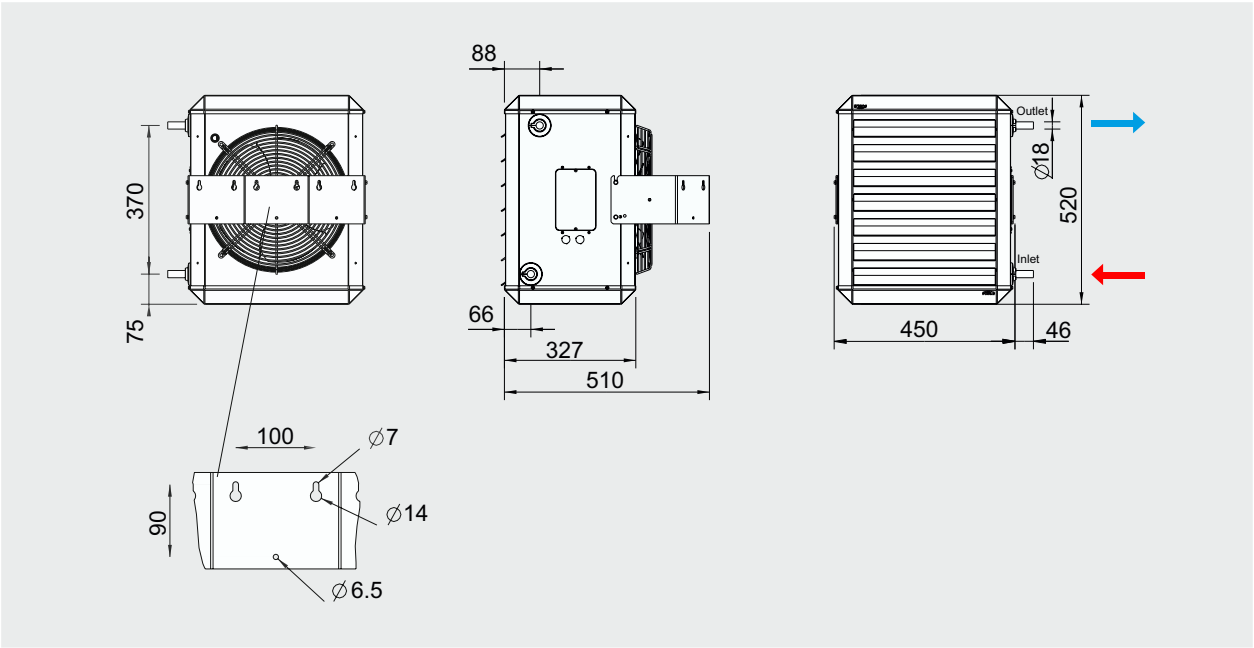
Technical specifications | Fan heater SW02

Type	Heat output*1	Airflow*2	Sound level*3	Voltage	Amperage	Weight
	[W]	[m³/h]	[dB(A)]	[V]	[A]	[kg]
SW02	8-10	0,20/0,31	34-45	230V~	0,31	15

*1) Applicable at water temperature 80/60 °C, surrounding temperature +15 °C, fan position min-max.
*2) Applicable at fan position min-max
*3) Applicable at fan position min-max. Conditions: Distance to fan 5 m. Direction factor: 2. Equivalent absorption area: 200 m².

Protection class: IP44.
CE compliant.

Dimensions



Mounting and connection

Mounting
The SW02 fan heater can be mounted on the wall for horizontal air inflow or on the ceiling for vertical air inflow.

Installation of the heating coil
Pipe connections can be made on either side of the fan heater. The heating coil has copper pipes with plain pipe connections, for solder or compression couplings. The bleed valve must be connected on the high point outside of the unit. Bleed and drain valve not included with the unit. For correct inlet and outlet connection of the heating coil, see the dimension diagrams.

Electrical installation
The SW02 fan heater is intended for permanent installation.

Output charts water

			Incoming / outgoing water temperature 130/65 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	16,8	47	0,06	14,2	52	0,05	12,9	54	0,05
	Med	0,27	15,2	49	0,06	12,6	54	0,05	11,8	56	0,04
	Min	0,20	12,6	54	0,05	10,6	58	0,04	9,6	60	0,04

			Incoming / outgoing water temperature 90/70 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	15,7	44	0,19	13,2	49	0,16	11,9	52	0,15
	Med	0,27	14,3	46	0,18	12,0	51	0,15	10,9	53	0,13
	Min	0,20	11,7	51	0,14	9,8	55	0,12	8,9	57	0,11

			Incoming / outgoing water temperature 80/60 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	13,3	39	0,16	10,8	43	0,13	9,6	46	0,12
	Med	0,27	12,1	40	0,15	9,9	45	0,12	8,8	47	0,11
	Min	0,20	9,9	44	0,12	8,1	48	0,10	7,2	49	0,09

			Incoming / outgoing water temperature 70/40 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	8,8	27	0,07	6,3	31	0,05	5,0	33	0,04
	Med	0,27	8,0	28	0,06	5,8	32	0,05	4,6	34	0,04
	Min	0,20	6,6	31	0,05	4,6	34	0,04	3,6	35	0,03

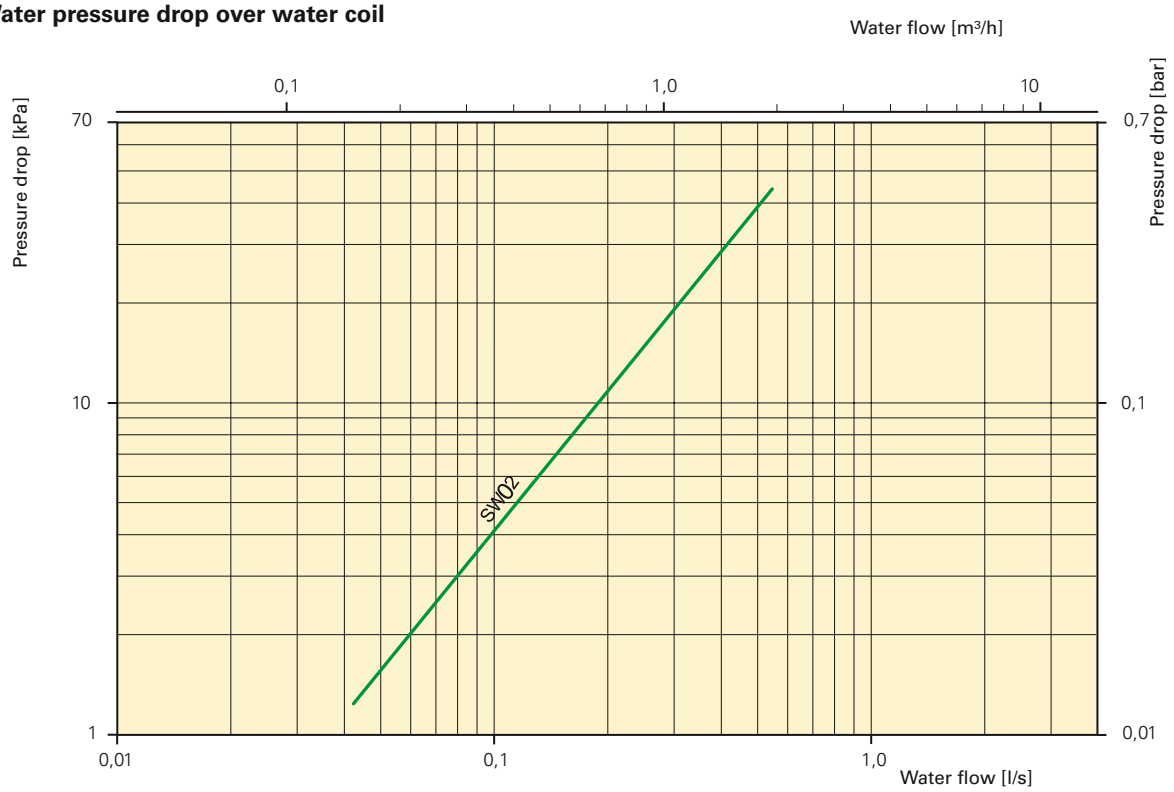
			Incoming / outgoing water temperature 60/40 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	8,5	26	0,10	6,1	31	0,07	4,9	33	0,06
	Med	0,27	7,7	27	0,09	5,5	32	0,07	4,4	34	0,05
	Min	0,20	6,3	30	0,08	4,5	33	0,05	3,6	35	0,04

			Incoming / outgoing water temperature 60/30 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	6,1	20	0,05	3,0	23	0,02	2,3	26	0,02
	Med	0,27	5,5	21	0,04	2,9	24	0,02	2,2	27	0,02
	Min	0,20	4,4	22	0,04	2,5	25	0,02	1,9	28	0,02

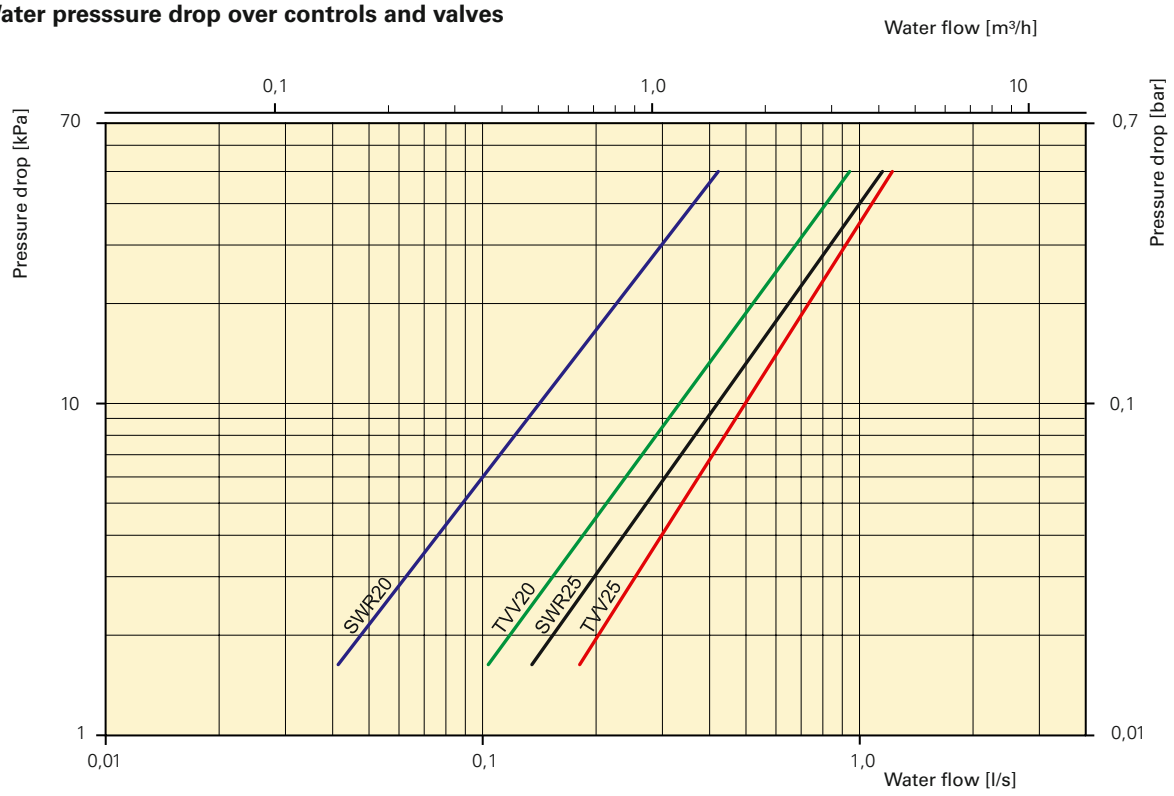
			Incoming / outgoing water temperature 55/35 °C								
			Incoming air temp. = 5 °C			Incoming air temp. = +15 °C			Incoming air temp. = +20 °C		
Type	**Fan position**	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW02	Max	0,31	7,2	23	0,09	4,8	28	0,06	3,5	29	0,04
	Med	0,27	6,6	24	0,08	4,4	28	0,05	3,2	30	0,04
	Min	0,20	5,4	26	0,06	3,5	29	0,04	2,4	30	0,03

Pressure drop water

Water pressure drop over water coil



Water presssure drop over controls and valves



The pressure drop is calculated for an average temperature of 70 °C (PVV 80/60).
For other water temperatures, the pressure drop is multiplied by the factor K.

Average temp. water °C	40	50	60	70	80	90
K	1.10	1.06	1.03	1.00	0.97	0.93

Control options

3-step control of airflow only

The airflow is manually controlled in three, fixed steps. No heat control, full water flow through the heating coil. Complete control equipment:

- CB30N, control panel

Thermostat and 3-step control

The thermostat starts/stops the fan and controls heating on/off. The airflow is manually controlled in 3 fixed steps. Complete control equipment:

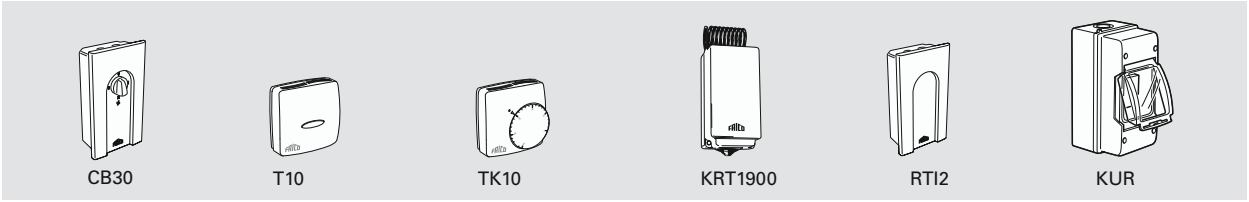
- CB30N, control panel
- KRT1900 or T10/TK10, room thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator

Thermostat and 3-step control with save-reduction

The thermostat starts/stops the fan and controls heating on/off. The airflow is manually controlled in 3 fixed steps. Save-reduction saves energy through lower temperatures, for example, at night and weekends. Complete control equipment:

- CB30N, control panel
- RTI2, 2-step thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator
- KUR, time switch

Controls and accessories



T10/TK10, thermostats

Processor controlled thermostats with concealed and visible dials. Setting range +5 – +30 °C. Connection voltage: 230 V. Max. breaking current: 10 A. IP30.

KRT1900, capillary tube thermostat

Capillary tube thermostat with concealed dial. Setting range 0 – +40 °C. Max. breaking current: 16/10 A (230/400 V). IP55.

RTI2, electronic 2-step thermostat

Processor controlled 2-step thermostat with concealed dial. Setting range +5 – +35 °C. Connection voltage 230 V (two potential free contacts). Max. breaking current: 16/10 A (230/400 V). IP44.

CB30N, control panel

Regulates the air flow in 3 steps. Supplied enclosed for wall mounting. Can regulate several units. Max. rated current: 10A. IP44.

KUR, digital time switch

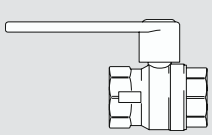
Digital weekly timer with 8 different program steps (36 memory places) equipped with a changeover contact. Max. breaking current: 10 A. IP44.

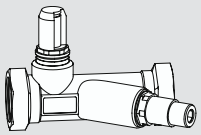
SWFT02, wire mesh filter

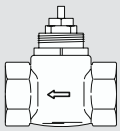
SW02 can be fitted with a wire mesh filter. The filter is fitted in front of the heating coil (slid into the provided slots) and is accessible both from above and below the heater.

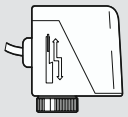
Type	Description	HxBxD [mm]
T10	Electronic thermostat	80x80x31
TK10	Electronic thermostat visible knob	80x80x31
KRT1900	Room thermostat	165x57x60
RTI2	2-step room thermostat	155x87x43
CB30N	Control box for SW02	155x87x43
KUR	Digital time switch	175x85x105
SWFT02	Basic filter	

Water regulation


AV20/25


JVF20/25


TVV20/25


SD20

SWR20/25, valve set
This valve set is suitable when there is need for adjusting the water flow and shutting it off (for the purpose of maintenance). The supply of heat is controlled by a thermostat. Pipe dimension for SWR20 is DN 20 (¾") and for SWR 25, DN 25 (1").

Add a suitable thermostat for controlling SWR20/25, like KRT1900 or T(K)10.

SWR20/25 consists of the following:

- **AV20/25, stop valve**
  Stops the water supply to SW. Consists of a ball valve which is either open or closed.

- **JVF20/25, adjustment valve**
  To adjust the water to desired flow. (kv value for JVF20 is 3,5 and kv value for JVF25 7,0).

- **TVV20/25, 2-way regulation valve**
  Pressure class PN16. Maximum pressure 2MPa (20Bar).
  Maximum pressure fall TVV20, 100kPa (1Bar).
  Maximum pressure fall TVV25, 62kPa (0,62Bar).

The kv value is adjustable in 3 stages:
TVV20: kv 1,6, kv 2,5 and kv 3,5
TVV25: kv 2,5, kv 4,0 and kv 5,5

- **SD20, actuator on/off 230V~**
  A thermostat controls the actuator to open and close, thereby regulating the supply of heat to SW. The closing time of the valve is 5 seconds, prevents sudden pressure changes in the pipe system. IP40.

TVV20/25, valve+ SD20, actuator
Water regulation with heat supply controlled by thermostat, but without the option of adjusting or stopping the water flow. Pipe dimension for TVV20 DN 20 (¾") and for TVV25, DN 25 (1").

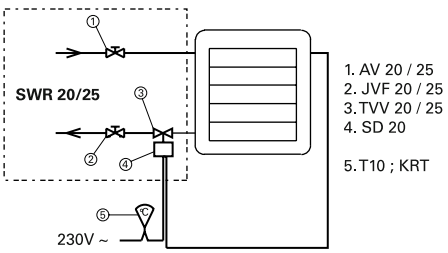
Add a suitable thermostat for controlling TVV20/25 + SD20, like KRT1900 or T10/TK10.

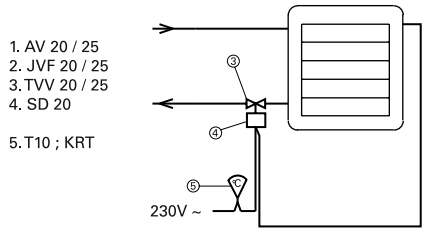
For this type of water regulation the following components are required:

- **TVV20/25, 2-way regulation valve**
  Pressure class PN16. Maximum pressure 2MPa (20Bar).
  Maximum pressure fall TVV20, 100kPa (1Bar).
  Maximum pressure fall TVV25, 62kPa (0,62Bar).

The kv value is adjustable in 3 stages:
TVV20: kv 1,6, kv 2,5 and kv 3,5
TVV25: kv 2,5, kv 4,0 and kv 5,5

- **SD20, actuator on/off 230V~**
  A thermostat controls the actuator to open and close, thereby regulating the supply of heat to SW. The closing time of the valve is 5 seconds, prevents sudden pressure changes in the pipe system. IP40.



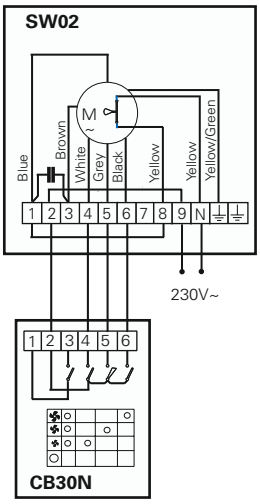


Type	Description
SWR20	Valve set connection 20 mm (¾")
SWR25	Valve set connection 25 mm (1")
TVV20	2-way control valve 20 mm (¾")
TVV25	2-way control valve 25 mm (1")
SD20	Acutator on/off 230V~ IP40

Wiring diagrams

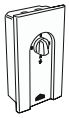
3-step control of airflow only

CB30N,
controlbox

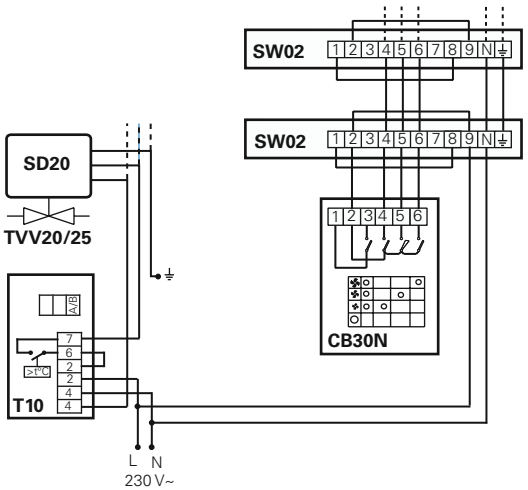


Thermostat and 3-step control

T10,
electronic thermostat



CB30N,
controlbox



SD20, actuator

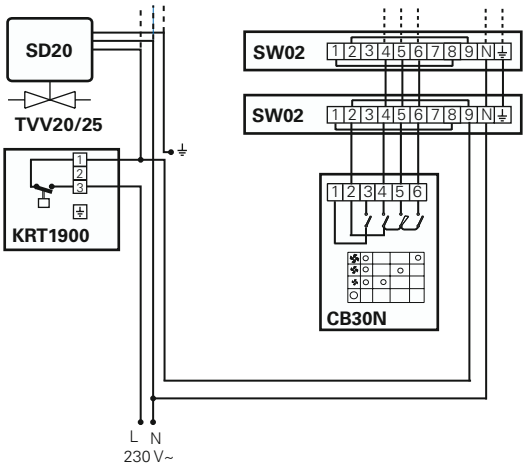
TVV20/25 two way
valve

Wiring diagrams

Thermostat and 3-step control

KRT1900,
room thermostat

CB30N,
controlbox

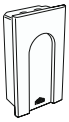


SD20, actuator

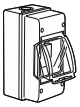
TVV20/25 two way
valve

Thermostat and 3-step control with save-reduction

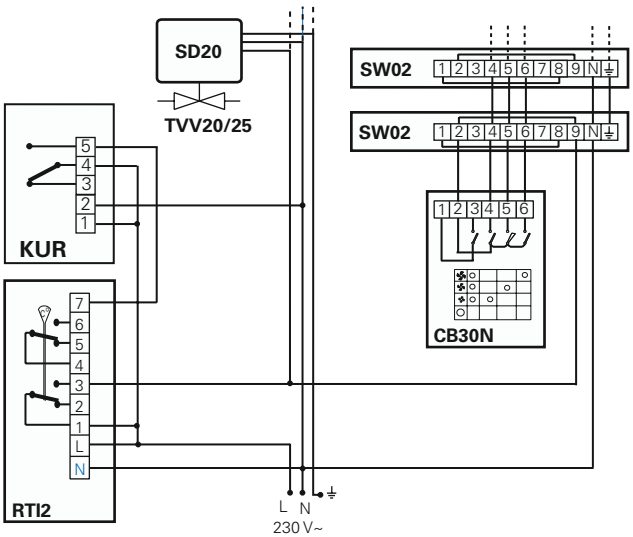
CB30N,
controlbox



RTI2,
electronic 2-step
thermostat



KUR,
digital time switch



SD20, actuator

TVV20/25 two way
valve

Water heat

4 models

CE

Fan heater SW12–33

Extremely quiet, power fan heater for water connection

Application

The low sound level and attractive design of the SW fan heater makes it ideal for use where fan heaters are traditionally used such as in industrial buildings and warehouses, but also in environments with high demands on low sound levels, for example, stores and assembly halls. The SW fan heater is designed for the connection of water and can be mounted either on the wall or ceiling.

Comfort

The SW fan heater gives a pleasant heat and is Frico's quietest fan heater. Very low sound levels are achieved by optimising the air flow through the heating coil. Sound level for SW12 can be as low as 35dB(A). All models are equipped with air directors that feature individually adjustable louvres so that hot air can be directed where required.

Operation and economy

Frico's air fan heaters have a long life, providing fast and effective heating at a low cost. The four different SW models, and the possibility to adjust the air flow in several steps, give energy efficient output.

Design

The SW fan heater has an attractive design in white sheet steel to blend into both industrial and shop environments.

Product specifications

- The air fan heater SW is available in four designs:
  - **SW12:** air flow 0.51 m³/s, heat output 17 kW, IP44.
  - **SW22:** air flow 0.91 m³/s, heat output 30 kW, IP44.
  - **SW32:** air flow 1.72 m³/s, heat output 50 kW, IP54.
  - **SW33:** air flow 1.59 m³/s, heat output 65 kW, IP54.

  (Applies at water temperature 80/60 °C, ambient temperature 15 °C, fan setting 3.)
- Very low sound level.
- Mounted on the wall or ceiling.
- Intended for water temperatures up to +110 °C in the standard design, but available for water temperatures up to +130 °C in special designs.
- Supplied with air director with individually adjustable louvres that direct the air flow on one plane.
- Three fan speeds.
- Wide range of controls and accessories.
- Mixing cabinet, that combines heating and ventilation, and a separate filter section available as an accessory.
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels. Colour: RAL 9016, NCS 0500 (white). Aluminium louvres.

In a food store it is extremely important that the temperature is neither too high nor low. Fan heater SW is easy to control.

Thanks to extremely silent operation and refined design, SW can be used in conference rooms for example.

The low sound level combined with powerful performance makes SW the perfect choice for everything from exhibition halls to workshops.

Technical specifications | Fan heater SW

Type	Heat output *1	Air flow*2	Air distribution*2	Sound level*3	Water volume*4	Voltage	Rated/max current	Weight
	[kW]	[m³/s]	[m]	[dB(A)]	[l]	[V]	[A]	[kg]
SW12	12/17	0.30/0.51	3 - 6	35 - 49	1.9	230V~	0.58/1.0	25
SW22	23/30	0.50/0.91	4 - 8	41 - 52	3.2	230V~	0.94/1.4	30
SW32	28/50	0.67/1.72	6 - 11	39 - 60	4.8	230V~	2.3/2.8	40
SW33	35/65	0.63/1.59	5 - 10	38 - 60	6.5	230V~	2.3/2.8	45

*1) Valid when the water temperature is 80/60°C, the surrounding temperature +15°C, fan position min – max.
*2) Applies to fan position 1 – 3. For further information, see air flow and air distribution tables.
*3) Applies to fan position 1 – 3. For further information, see sound levels table.
*4) Water volume inside battery.

Protection class SW12-22: IP44.
Protection class SW32-33: IP54.
CE compliant.

Components

Housing
Corrosion proof housing made of hot zinc-plated and powder coated steel panels. Colour: RAL 9016. Housing without lacquer or in other colours available on request.

Fan unit
Axial fan with an integrated, fully enclosed single-phase 230 V~ motor, 50Hz. Protection class IP44. Maximum surrounding temperature +40°C.

The fan motor is prepared for multiple fan speed control (only SW12 and SW22). For external fan speed control, see section on control options. The motor in all models is equipped with an automatically returning thermocontact which is connected to the terminal block.

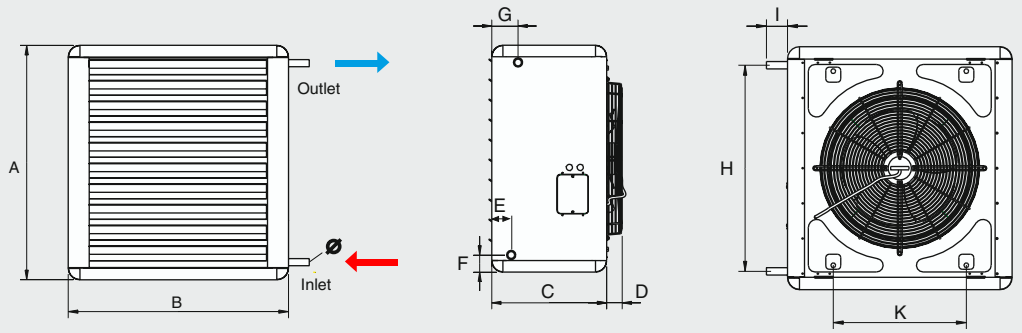
Water heating coil
Heating coil with aluminium fins (fins distance 2 mm) and copper pipes. Smooth pipe connections, for soldering or clamping ring pipe connection.

In standard designs, SW is intended for hot water up to +110 °C and 10 bar. SW is also available in special designs for water temperatures up to +130 °C and 16 bar.

Heating coils are pressure tested for 15 bar. Maximum working pressure (standard) is 10 bar.

Air director
All models are delivered with individually adjustable lourves for controlling the air stream in one direction. Louvres are of anodized aluminium.

Dimensions

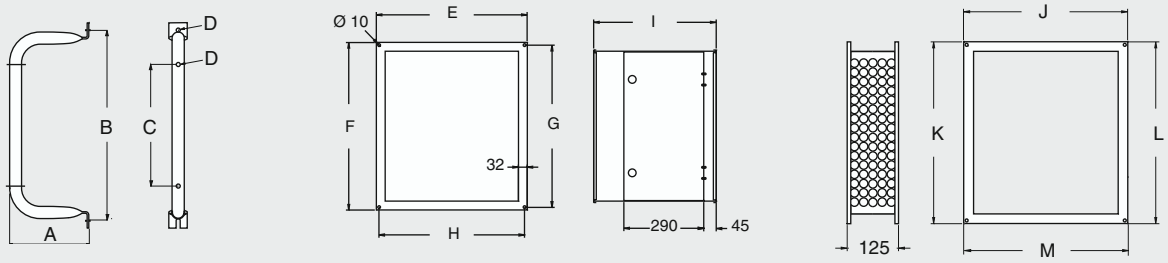


Type	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	Ø [mm]
SW12	580	525	340	65	60	60	80	470	60	260	18
SW22	725	680	370	40	60	60	80	620	60	400	22
SW32/33	855	820	450	80	85	60	125	725	70	530	28

Brackets, SWK

Filter section, SWF

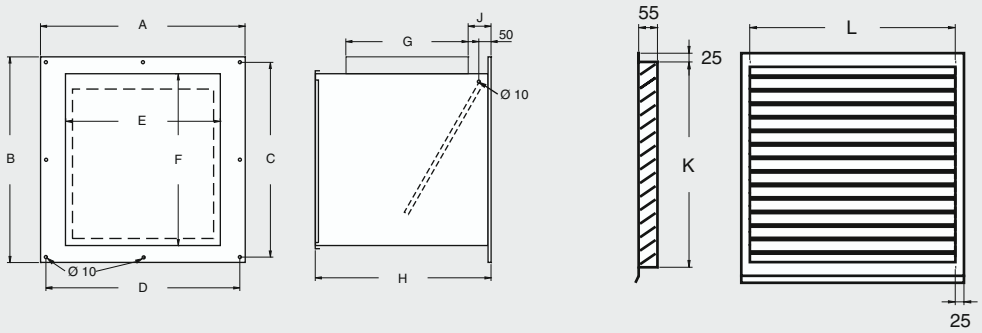
Return air intake, SWD



Type	A [mm]	B [mm]	C [mm]	D Ø [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	J [mm]	K [mm]	L [mm]	M [mm]
SW12	195	460	300	10	465	490	470	442	525	465	490	470	442
SW22	250	570	400	10	550	605	585	525	445	550	605	585	525
SW32/33	335	700	530	12	675	725	705	655	570	675	725	705	655

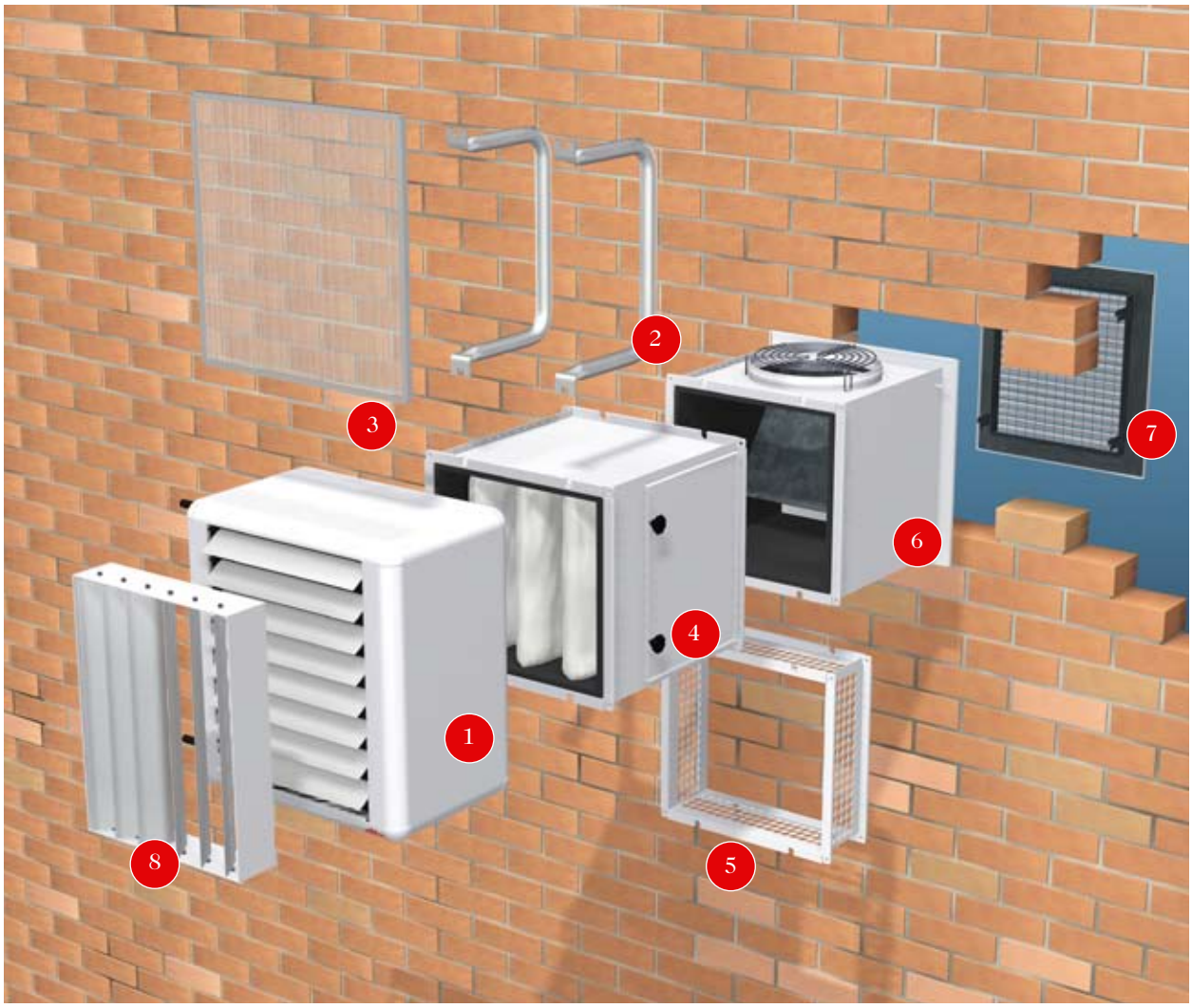
Mixing cabinet, SWBS

Outer wall grille, SWY

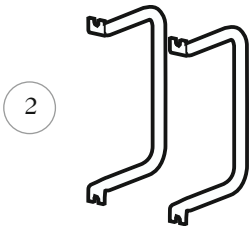


Type	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G Ø [mm]	H [mm]	J [mm]	K [mm]	L [mm]
SW12	465	570	540	442	400	430	315	535	95	500	400
SW22	670	670	630	630	485	540	400	580	85	600	600
SW32/33	770	870	830	730	610	650	500	700	105	800	700

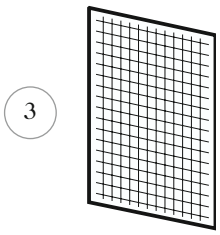
Accessories



1) Fan heater SW
2) Mounting brackets SWK
3) Basic filter SWFT
4) Filter section SWF
5) Return air intake SWD
6) Mixing cabinet SWBS
7) Outer wall grille SWY
8) Extra air director SWLR

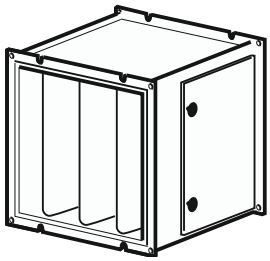


Mounting brackets, SWK
When not using the filter section or mixing cabinet the main unit is suspended from the wall or ceiling using brackets SWK (fig 2). Brackets are extra and supplied as a pair.



Basic filter, SWFT
Used as an alternative to the filter section. Provides the heating coil with basic protection. The filter is easily fitted into the SW unit and can be cleaned from either the top or bottom of the SW unit. The SW unit has a re-usable filter (fig 3).

4

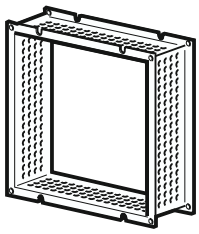


Filter section, SWF
Fig. 4. Filters the outdoor air or/and return air from particles that might reduce the performance and reliability of SW. The disposable deep-pleated bagfilter is a cassette of synthetic material. Filterclass G85 (EU3). The filter section is equipped with filter on delivery.

Note! If the filter section is not used in combination with the mixing cabinet, a return air intake (SWD) is required.

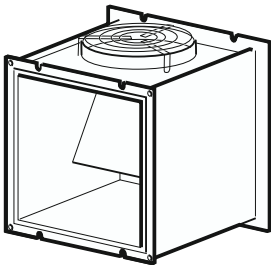
Extra filtercassette, SWEF
Replacement filter for SWF.

5



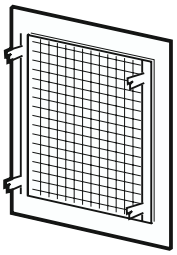
Return air intake, SWD
Fig. 5. Allows air intake when filter section is used without mixing cabinet SWBS. Return air intake is not required when the mixing cabinet is used.

6



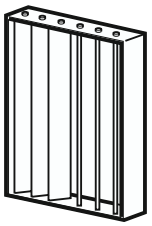
Mixing cabinet, SWBS
Fig. 6. The mixing cabinet is used to combine ventilation with heating by mixing outdoor air with return air. The mixture ratio is controlled and infinitely variable with a damper, either manually or with a damper motor.

7



Outer wall grille, SWY
Fig. 7. For intake of fresh air into the mixing cabinet. Grille of hot zinc-plated steel panels.

8



Extra air director, SWLR
Fig. 8. To direct the air stream sideways. On delivery, SW is equipped with an air director for vertical direction of the air stream. Individually adjustable louvres in anodized aluminium.

The extra air director is mounted to SW by hooking it onto the existing air director.

Type	Description
SWK1	Mounting brackets SW12
SWK2	Mounting brackets SW22
SWK3	Mounting brackets SW32/SW33
SWF1	Filter section SW12
SWF2	Filter section SW22
SWF3	Filter section SW32/SW33
SWD1	Return air intake SW12
SWD2	Return air intake SW22
SWD3	Return air intake SW32/SW33
SWEF1	Extra filter cassette EU3 SW12
SWEF2	Extra filter cassette EU3 SW22
SWEF3	Extra filter cassette EU3 SW32/SW33
SWFT1	Basic filter SW12
SWFT2	Basic filter SW22
SWFT3	Basic filter SW32/SW33
SWBS1	Mixing cabinet SW12
SWBS2	Mixing cabinet SW22
SWBS3	Mixing cabinet SW32/SW33
SWY1	Outer wall grille SW12
SWY2	Outer wall grille SW22
SWY3	Outer wall grille SW32/SW33
SWLR1	Extra air director sideways SW12
SWLR2	Extra air director sideways SW22
SWLR3	Extra air director sideways SW32/SW33

Connection from the left

Connection from the right

Ceiling mounting

Mounting
SW fan heaters can be permanently mounted on a wall for horizontal air distribution, or on the ceiling for vertical air distribution. SW accessories are assembled with screws or guides and then fitted to the wall or ceiling with suitable fasteners. Mounting brackets are extra.

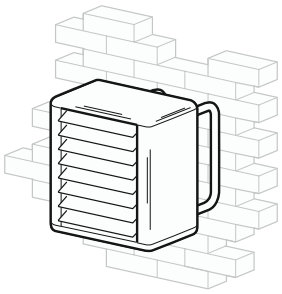
Connection of heating coil
The pipes can be connected on either side of SW. Heating coil with aluminium fins (fin spacing 2 mm) and copper pipes. Smooth pipe connections for soldering or compression fittings. The air valve should be connected on a high point in the pipe system. Air and draining valves are not included in the heating coil. For correct inlet and outlet connection of the heating coil, see dimension sketch.

SW units that are likely to be exposed to air temperatures below zero, for example when a mixing cabinet is used it should be equipped with external frost protection to ensure that the heating coil is not damaged by frost.

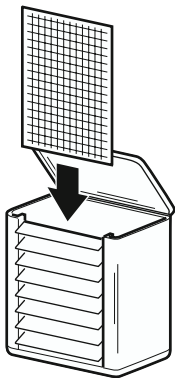
Connection
The following applies to SW 12 and 22: The fan motor is connected via the connection box located on the side of the unit. On the side of the unit there are two cable glands with knock outs ø 20 mm.

The following applies to SW 32 and 33: The fan motor is connected directly to the terminal box which is positioned on the motor and easy accessible from the outside of the unit. When a mixing cabinet or a filter section is used, holes must be made in the casing for connection cables.

Mounting and installation of accessories



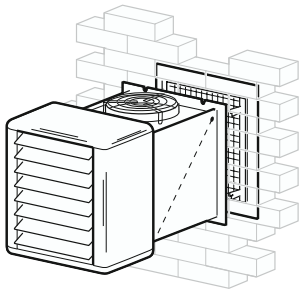
SW fitted on a wall with mounting brackets



SW with basic filter

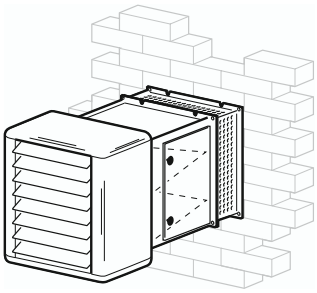
Mounting SW
Mounting brackets SWK are to be ordered separately. A set of screws are included for fixing on the back side of SW. The brackets are fitted on the wall or on the ceiling with suitable fasteners.

Mounting basic filter SWFT in SW
This basic filter is very easy to fit into SW. The top or bottom lid is opened, and the filter is pushed down behind the coil in tracks for this purpose.



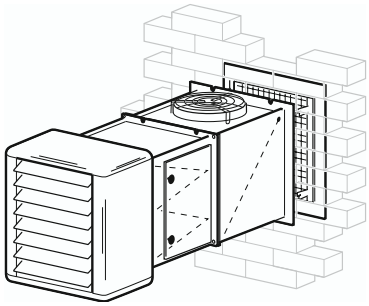
SW mixing cabinet and outer wall grille

Mounting SW with mixing cabinet SWBS (no filter section)
The mixing cabinet is fitted to SW and the assembly is fitted to the wall with suitable fasteners. The construction should be well supported from the wall or ceiling. Supports not included.



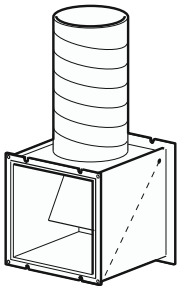
SW with filter section and return air intake

Mounting SW with filter section SWF (no mixing cabinet)
When a filter section is used without a mixing cabinet, the filter section must be attached to the return air intake (SWD) to allow for air intake.



SW with filter section, mixing cabinet and outer wall grille

Mounting SW with mixing cabinet SWBS and filter section SWF
The mixing cabinet and filter section are fitted together (see as above sketch). The mixing cabinet is fitted to the wall with suitable fasteners. The construction should be well supported from the wall or ceiling. Supports not included.



Mixing cabinet with return air duct

Mounting return air duct with mixing cabinet
When a return air duct is used with the mixing cabinet, a suitable circular duct is fitted to the mixing cabinet after removing the circular protection grille.

Control options SW12 and SW22

Control by thermostat only
The thermostat starts/stops the fan and also controls the heat supply on/off. The fan is preset to one single speed.
Complete regulation kit:

- KRT1900 or T10/TK10, room thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator

3-step control of airflow only
The air flow is manually regulated in 3 steps. No heat regulation, maximum water flow through the heating coil.
Complete regulation kit:

- SWR2, 3-step fan speed control

Thermostat and 3-step control
The thermostat starts/stops the fan and also controls the heat supply on/off. The air flow is regulated manually in 3 steps.
Complete regulation kit:

- SWR2, 3-step fan speed control
- KRT1900 or T10/TK10, room thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator

Automatic temperature and airflow control
A convenient solution with automatic regulation of both air flow and heat supply. The thermostat alternates between low/high fan speed and controls the heat supply on/off.
Complete regulation kit:

- SWR1, air flow/temperature regulator (thermostat included)
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator

Control options SW32 and SW33

Control by thermostat only
The thermostat starts/stops the fan and also controls the heat supply on/off. The fan is set to run on high speed.
Complete regulation kit:

- KRT1900 or T10/TK10, room thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, acutator

5-step control of airflow only
The air flow is manually regulated in 5 steps. No heat regulation, maximum water flow through the heating coil.
Complete regulation kit:

- RE3, 5-step regulator max 3A, or RE7, 5-step regulator max 7A

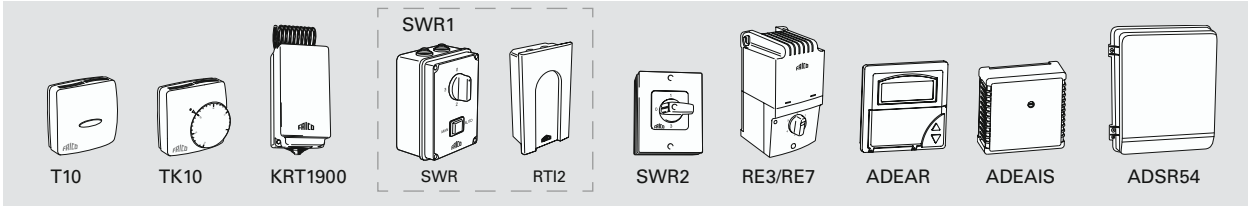
Thermostat and 5-step control
The thermostat starts/stops the fan and also controls the heat supply on/off. The air flow is manually regulated in 5 steps.
Complete regulation kit:

- RE3, 5-step regulator max 3A, or RE7, 5-step regulator max 7A
- KRT1900 or T10/TK10, room thermostat
- SWR20/25, valve set, or TVV20/25, valve + SD20, actuator

Automatic speed regulation
The heat is regulated by automatically changing the air flow depending on the room temperature. The system is based on an advanced microprocessor control system with an attractive design. All parameters are preset which gives simple and quick installation. Complete control equipment:

- ADEAR, controller with display unit and integrated room sensor
- ADEAIS, external room sensor
- ADSR54, electronic voltage control

Controls



T10/TK10, thermostats
Processor controlled thermostats with concealed and visible dials. Setting range +5 – +30 °C. Connection voltage: 230 V. Max. breaking current: 10 A. IP30.

KRT1900, capillary tube thermostat
Capillary tube thermostat with concealed dial. Setting range 0 – +40 °C. Max. breaking current: 16/10 A (230/400 V). IP55.

SWR1, automatic temperature control
Only for SW12 and SW22. Consists of a unit for changing-over the air flow SWR and 2-step thermostat RTI2. SWR consists of a 3-step change-over switch for the air flow (positions 0-1-2-3) and a change-over switch for manual/automatic operation. Controls up to six SW's in parallel.

Manual: Desired air flow is set with the 3-step change-over switch. The thermostat regulates the heat on/off. (When the need for heat increases the fan speed must be increased.)

Automatic: The thermostat regulates the air flow in 2 steps and the heat on/off. The 3-step change-over switch is preset to position 1, 2 or 3 depending on how one wishes to control the air flow. When there is no need for heating, the fan is shut off and the actuator is closed. When heat is needed the actuator opens and the fan starts at low speed. If the room temperature continues to drop, the fan will speed up to the preset value. If the 3-step switch is preset to position 1 the fan will run on low speed only. If position 2 is preset, the fan will speed up from low to middle. If position 3 is preset, the fan will speed up from low to high. IP44.

SWR2, 3-step fan speed control
Only for SW12 and SW22. 3-step fan speed control. Controls up to six SW's in parallel. IP44. To control the heat, a suitable thermostat and a valve set or a single valve + actuator are needed .

RE3/RE7, 5-step change-over switch for air flow
Only for SW32 and SW33. Controls the air flow in 5 steps. **RE3** controls up to one SW, maximum 3 A. **RE7** controls up to two SW's in parallel, maximum 7 A. To control the heat, a suitable thermostat and a valve set or a single valve + actuator are needed. IP54

ADEAR, regulator
Regulator with display unit and built in room sensor. Regulates the heating by automatically changing the air flow depending on the room temperature. IP30.

ADEAIS, external room sensor
External room sensor. IP30.

ADSR54, electronic voltage control
Controls the motor without disruptive electromagnetic noise occurring. Can be controlled by an external 0-10 V-signal. Rated current 3 A, 230 V~. IP54.

SWMSK, motor protection
Thermal motor cut-out with manual reset and alarm function.

Type	Description	HxWxD [mm]
T10	Electronic thermostat	80x80x31
TK10	Electronic thermostat with visible knob	80x80x31
KRT1900	Room thermostat	165x57x60
SWR1	Automatic regulation of air flow/temperature.	160x120x100
SWR2	3-stage regulator air flow	100x80x90
RE3	5-stage regulator air flow	200x105x105
RE7	5-stage regulator air flow	247x147x145
ADEAR	Regulator	89x89x26
ADEAIS	External room sensor	75x75x27
ADSR54	Stepless fan speed control	255x190x110
SWMSK	Motorskydd	

Controls, mixing cabinet

SWSTYR1, complete automatic anti-freeze system
Used with the mixing cabinet and where there is a risk of the temperature dropping below 0 °C. Fan heaters and exhaust air fan can be started via the time channel in the control cabinet. The damper for outdoor air (powered down closed) is opened during start up. During night operation the fan heater is started with full return air to heat the premises. The exhaust air fan is not operational during night operation.

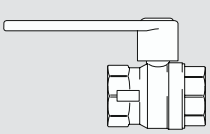
The building temperature is controlled via a room sensor and the inflow temperature can be min and max limited via the sensor in the fan heater's outlet. The temperature sensor on the water circuit's return side stops the fan heater and closes the outdoor air damper with a risk of freezing, and maintains the coil circuit heat at approximately +25 °C when the fan heater stops.

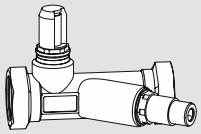
The delivery includes control cabinet, sensor, 3-way valve/motor, damper motor with spring return. Exhaust air fan and circulation pump not included. (NOTE! pump needed in the secondary circuit to guarantee the function.)

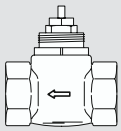
SWSM01, damper motor for mixing cabinet
The motor is provided with spring reversion and fitted on the shaft of the damper. If required, the damper motor can be mounted on the opposite side of the mixing cabinet by loosening the screws which hold the shaft. Note! Units that are provided with mixing cabinets and are at risk for outdoor temperatures lower than freezing point, shall be provided with required frost protection inhibitor, e.g. SWSTYR1. Please contact Frico Technical support, for more information.

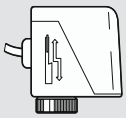
Type	Description
SWSTYR1	Complete automatic anti-freeze system
SWSM01	Damper motor for mixing cabinet

Water regulation


AV20/25


JVF20/25


TVV20/25


SD20

SWR20/25, valve set
This valve set is suitable when there is need for adjusting the water flow and shutting it off (for the purpose of maintenance). The supply of heat is controlled by a thermostat. Pipe dimension for SWR20 is DN 20 (¾") and for SWR 25, DN 25 (1").

Add a suitable thermostat for controlling SWR20/25, like KRT1900 or T(K)10.

SWR20/25 consists of the following:

- **AV20/25, stop valve**
  Stops the water supply to SW. Consists of a ball valve which is either open or closed.

- **JVF20/25, adjustment valve**
  To adjust the water to desired flow. (kv value for JVF20 is 3,5 and kv value for JVF25 7,0).

- **TVV20/25, 2-way regulation valve**
  Pressure class PN16. Maximum pressure 2MPa (20Bar).
  Maximum pressure fall TVV20, 100kPa (1Bar).
  Maximum pressure fall TVV25, 62kPa (0,62Bar).

The kv value is adjustable in 3 stages:
TVV20: kv 1,6, kv 2,5 and kv 3,5
TVV25: kv 2,5, kv 4,0 and kv 5,5

- **SD20, actuator on/off 230V~**
  A thermostat controls the actuator to open and close, thereby regulating the supply of heat to SW. The closing time of the valve is 5 seconds, prevents sudden pressure changes in the pipe system. IP40.

TVV20/25, valve+ SD20, actuator
Water regulation with heat supply controlled by thermostat, but without the option of adjusting or stopping the water flow. Pipe dimension for TVV20 DN 20 (¾") and for TVV25, DN 25 (1").

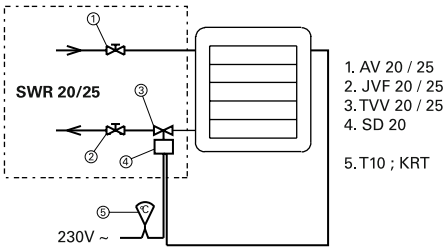
Add a suitable thermostat for controlling TVV20/25 + SD20, like KRT1900 or T10/TK10.

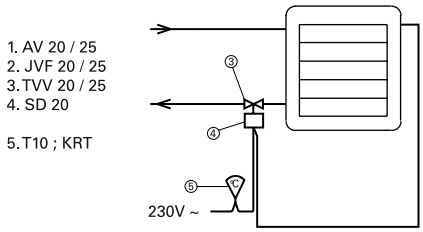
For this type of water regulation the following components are required:

- **TVV20/25, 2-way regulation valve**
  Pressure class PN16. Maximum pressure 2MPa (20Bar).
  Maximum pressure fall TVV20, 100kPa (1Bar).
  Maximum pressure fall TVV25, 62kPa (0,62Bar).

The kv value is adjustable in 3 stages:
TVV20: kv 1,6, kv 2,5 and kv 3,5
TVV25: kv 2,5, kv 4,0 and kv 5,5

- **SD20, actuator on/off 230V~**
  A thermostat controls the actuator to open and close, thereby regulating the supply of heat to SW. The closing time of the valve is 5 seconds, prevents sudden pressure changes in the pipe system. IP40.





Type	Description
SWR20	Valve set anslutning 20 mm (¾")
SWR25	Ventilsats anslutning 25 mm (1")
TVV20	2-vägsventil anslutning 20 mm (¾")
TVV25	2-vägsventil anslutning 25 mm (1")
SD20	Ställdon on/off 230V~ IP40

Air flow and air distribution charts

Type	Fan position	Fan speed	Air flow		Air flow*1 with accessories		Distribution*2
		[rpm]	[m³/s]	[m³/h]	[m³/s]	[m³/h]	[m]
SW12	Max	1350	0.65	2340	0.47	1700	6.5
	3	1100	0.51	1840	0.33	1175	5.5
	2	940	0.42	1510	---	---	4.0
	1	680	0.30	1080	---	---	3.0
SW22	Max	1420	1.13	4070	0.67	2400	8.5
	3	1150	0.91	3280	0.47	1700	7.5
	2	900	0.64	2300	---	---	5.5
	1	750	0.50	1800	---	---	4.0
SW32	5	930	1.72	6190	1.23	4430	11.0
	4	790	1.44	5180	0.95	3420	9.0
	3	570	1.03	3710	0.61	2210	7.0
	2	390	0.67	2430	---	---	5.5
SW33	5	930	1.59	5710	1.19	4270	10.0
	4	775	1.30	4680	0.89	3200	8.0
	3	540	0.88	3170	0.59	2130	6.5
	2	390	0.63	2260	---	---	5.0

*1) Including filter section, mixing cabinet and outer wall grille. Please note that with only mixing cabinet and outer wall grille, the air flow is only marginally reduced.

*2) The air distribution data above is valid when the horizontally adjustable air director is used and the inlet temperature is +40°C and the room temperature is +18°C. The air distribution is defined as the distance in a straight angle from the fan heater to the the point where the air speed has dropped to 0,2 m/s.

Soundlevels chart

Type	Fan position	Sound	Sound	Sound at frequency:							
		Lp [dB(A)]	Lw [dB(A)]	63 Hz [dB(A)]	125 Hz [dB(A)]	250 Hz [dB(A)]	500 Hz [dB(A)]	1000 Hz [dB(A)]	2000 Hz [dB(A)]	4000 Hz [dB(A)]	8000 Hz [dB(A)]
SW12	3	49	65	31	48	59	60	60	58	50	43
	2	43	59	32	42	54	54	53	50	42	35
	1	35	51	34	37	47	44	44	40	29	21
SW22	3	52	68	69	74	69	61	63	61	54	47
	2	47	63	55	57	62	58	59	57	50	44
	1	41	57	57	52	57	53	53	51	42	37
SW32	5	60	76	62	77	75	70	72	70	61	54
	4	56	72	60	68	69	66	69	65	56	49
	3	47	63	66	64	63	60	60	54	45	37
	2	39	55	59	60	57	53	49	43	33	25
SW33	5	60	76	68	75	75	69	72	69	61	53
	4	55	71	64	67	67	65	68	64	55	48
	3	46	62	55	65	61	59	58	52	43	36
	2	38	55	58	61	55	53	50	43	35	29

Lp = Sound pressure level, Lw = Sound power level.
Conditions: Distance to fan 5 m. Direction factor: 2. Equivalent absorption area: 200 m².
All tests are performed in accordance with BS148, AMCA standard 210-85 and DIN 24163.

Output charts water

			Incoming / outgoing water temperature 80/60°C								
			Incoming air temp. = -15°C			Incoming air temp. = 0°C			Incoming air temp. = +15°C		
Type	**Fan position***	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**
SW12	Max	0.65	30.5	23.4	0.36	24.8	31.3	0.29	19.1	39.1	0.22
	3	0.51	26.4	27.4	0.31	21.5	34.5	0.25	16.6	41.7	0.19
	2	0.42	23.4	30.7	0.27	19.1	37.3	0.22	14.8	43.8	0.17
	1	0.30	18.9	36.7	0.22	15.5	42.2	0.18	12.0	47.8	0.14
SW22	Max	1.13	54.2	24.3	0.64	44.2	32.0	0.52	34.2	39.8	0.40
	3	0.91	47.6	27.8	0.56	38.9	35.0	0.46	30.1	42.1	0.35
	2	0.64	38.3	34.0	0.45	31.3	40.1	0.37	24.3	46.1	0.29
	1	0.50	32.6	38.5	0.43	26.7	43.8	0.31	20.8	49.1	0.24
SW32	5	1.72	79.6	22.9	0.95	64.8	30.9	0.77	50.0	38.8	0.59
	4	1.44	71.1	25.8	0.85	58.4	33.2	0.69	45.1	40.6	0.53
	3	1.03	58.5	29.2	0.69	47.7	37.9	0.56	36.9	44.4	0.44
	2	0.67	44.4	31.5	0.52	36.3	44.4	0.43	28.2	49.5	0.33
SW33	5	1.59	102.0	37.5	1.21	83.5	43.0	0.99	65.0	48.5	0.77
	4	1.30	89.2	41.2	1.06	73.2	46.1	0.87	57.1	51.0	0.68
	3	0.88	68.2	48.5	0.81	56.0	52.2	0.66	43.8	55.8	0.52
	2	0.63	53.4	54.5	0.63	44.0	57.2	0.52	34.6	59.9	0.41

			Incoming / outgoing water temperature 60/40°C								
			Incoming air temp. = -15°C			Incoming air temp. = 0°C			Incoming air temp. = +15°C		
Type	**Fan position***	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow l/s]**
SW12	Max	0.65	22.5	13.4	0.26	16.8	21.2	0.20	11.1	29.0	0.13
	3	0.51	19.5	16.4	0.23	14.6	23.5	0.17	9.7	30.6	0.11
	2	0.42	17.4	18.9	0.20	13.0	25.5	0.15	8.7	32.0	0.10
	1	0.30	14.1	23.5	0.16	10.6	29.0	0.12	7.1	34.4	0.08
SW22	Max	1.13	40.2	14.2	0.48	30.2	21.9	0.36	20.2	29.6	0.24
	3	0.91	35.4	16.9	0.42	26.7	24.0	0.31	17.8	31.0	0.21
	2	0.64	28.6	21.6	0.34	21.6	27.6	0.25	14.5	33.6	0.17
	1	0.50	24.4	25.0	0.29	18.5	30.3	0.22	12.5	35.5	0.14
SW32	5	1.72	58.8	13.0	0.70	44.0	21.0	0.52	29.1	28.9	0.34
	4	1.44	53.1	15.2	0.63	39.8	22.6	0.47	26.4	30.0	0.31
	3	1.03	43.4	19.5	0.51	32.6	26.0	0.38	21.8	32.2	0.26
	2	0.67	33.1	25.5	0.40	25.0	30.6	0.29	16.8	35.5	0.20
SW33	5	1.59	76.4	24.4	0.91	57.9	29.8	0.69	39.2	35.2	0.46
	4	1.30	67.0	27.2	0.79	50.9	32.1	0.60	34.5	36.8	0.40
	3	0.88	51.4	32.9	0.61	39.2	36.5	0.46	26.8	40.0	0.32
	2	0.63	40.5	37.6	0.48	31.0	40.3	0.36	21.4	42.8	0.25

*) Air flow, air distribution and sound levels for all fan positions are shown on the previous page.

Note! All specifications are shown for SW without accessories. With filter section, air flow and output are reduced.
In the tables for air flow and air distribution on the previous page, air flow data for SW with accessories is shown.

Output charts water

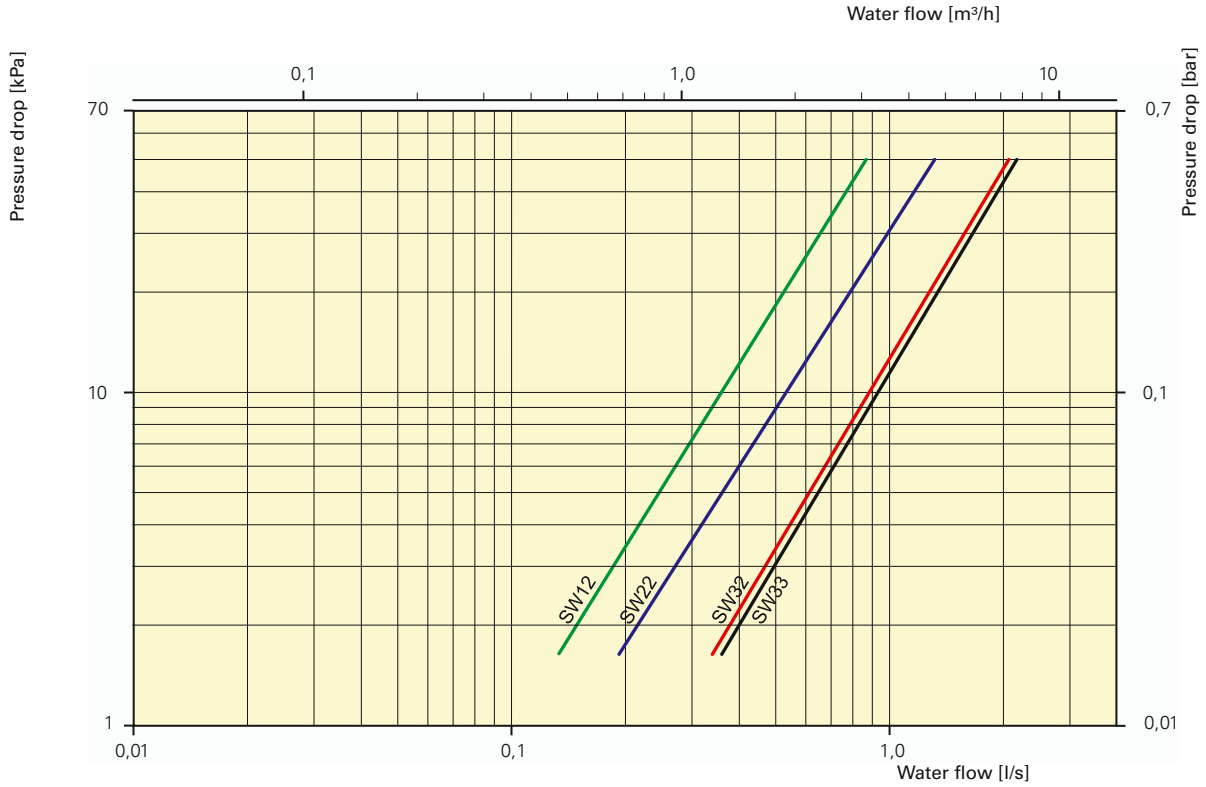
			Incoming / outgoing water temperature 60/30°C								
			Incoming air temp. = -15°C			Incoming air temp. = 0°C			Incoming air temp. = +15°C		
Type	**Fan position***	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow l/s]**
SW12	Max	0.65	19.4	9.5	0.15	13.7	17.2	0.10	7.8	24.8	0.06
	3	0.51	16.9	12.2	0.13	12.0	19.2	0.09	6.9	26.1	0.05
	2	0.42	15.1	14.5	0.12	10.7	20.9	0.08	6.2	27.1	0.04
	1	0.30	12.3	18.7	0.09	8.8	21.1	0.07	5.2	29.1	0.04
SW22	Max	1.13	35.1	10.4	0.27	24.9	18.1	0.19	14.5	25.5	0.11
	3	0.91	31.0	12.9	0.24	22.1	19.9	0.17	12.9	26.7	0.10
	2	0.64	25.2	17.2	0.20	18.1	23.1	0.14	10.7	28.7	0.08
	1	0.50	21.6	20.4	0.17	15.6	25.5	0.12	9.3	30.2	0.07
SW32	5	1.72	50.8	9.2	0.40	35.8	17.1	0.28	24.5	24.8	0.16
	4	1.44	45.9	11.1	0.36	32.5	18.5	0.25	18.7	25.6	0.14
	3	1.03	37.8	15.1	0.30	26.9	21.4	0.21	15.6	27.4	0.12
	2	0.67	29.1	20.6	0.23	20.9	25.5	0.16	12.3	30.0	0.09
SW33	5	1.59	67.8	19.9	0.53	48.9	25.2	0.38	29.3	30.1	0.23
	4	1.30	59.7	22.6	0.47	43.2	27.2	0.34	26.1	31.4	0.20
	3	0.88	46.2	28.0	0.36	33.7	31.4	0.26	20.6	34.2	0.16
	2	0.63	36.7	32.7	0.29	26.9	35.0	0.21	16.7	36.7	0.13

			Incoming / outgoing water temperature 55/35°C								
			Incoming air temp. = -15°C			Incoming air temp. = 0°C			Incoming air temp. = +15°C		
Type	**Fan position***	**Air flow [m³/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow [l/s]**	**Output out [kW]**	**Air temp. out [°C]**	**Water flow l/s]**
SW12	Max	0.65	20.5	10.8	0.24	14.8	18.7	0.17	9.1	26.5	0.10
	3	0.51	17.8	13.6	0.21	12.9	20.7	0.15	8.0	27.8	0.09
	2	0.42	15.8	15.9	0.18	11.5	22.5	0.13	7.2	28.9	0.08
	1	0.30	12.9	20.1	0.15	9.4	25.7	0.11	5.9	31.0	0.07
SW22	Max	1.13	36.7	11.6	0.43	26.7	19.4	0.31	16.6	27.1	0.19
	3	0.91	32.3	14.1	0.38	23.6	21.2	0.28	16.4	26.9	0.19
	2	0.64	26.1	18.4	0.31	19.1	24.5	0.22	12.0	30.4	0.14
	1	0.50	22.3	21.6	0.26	18.2	25.3	0.21	10.4	32.0	0.12
SW32	5	1.72	53.6	10.5	0.64	38.8	18.5	0.46	23.9	26.4	0.28
	4	1.44	48.4	12.5	0.57	35.1	20.0	0.41	21.7	27.3	0.25
	3	1.03	39.6	16.5	0.47	28.8	22.9	0.34	17.9	29.3	0.21
	2	0.67	30.2	22.0	0.36	22.1	27.1	0.26	13.9	32.0	0.16
SW33	5	1.59	69.9	21.0	0.83	51.4	26.5	0.61	32.6	32.0	0.38
	4	1.30	61.4	23.7	0.73	45.2	28.5	0.53	28.8	33.2	0.34
	3	0.88	47.2	28.9	0.56	34.9	32.5	0.41	22.5	35.9	0.26
	2	0.63	37.2	33.4	0.44	27.7	36.0	0.33	18.0	38.4	0.21

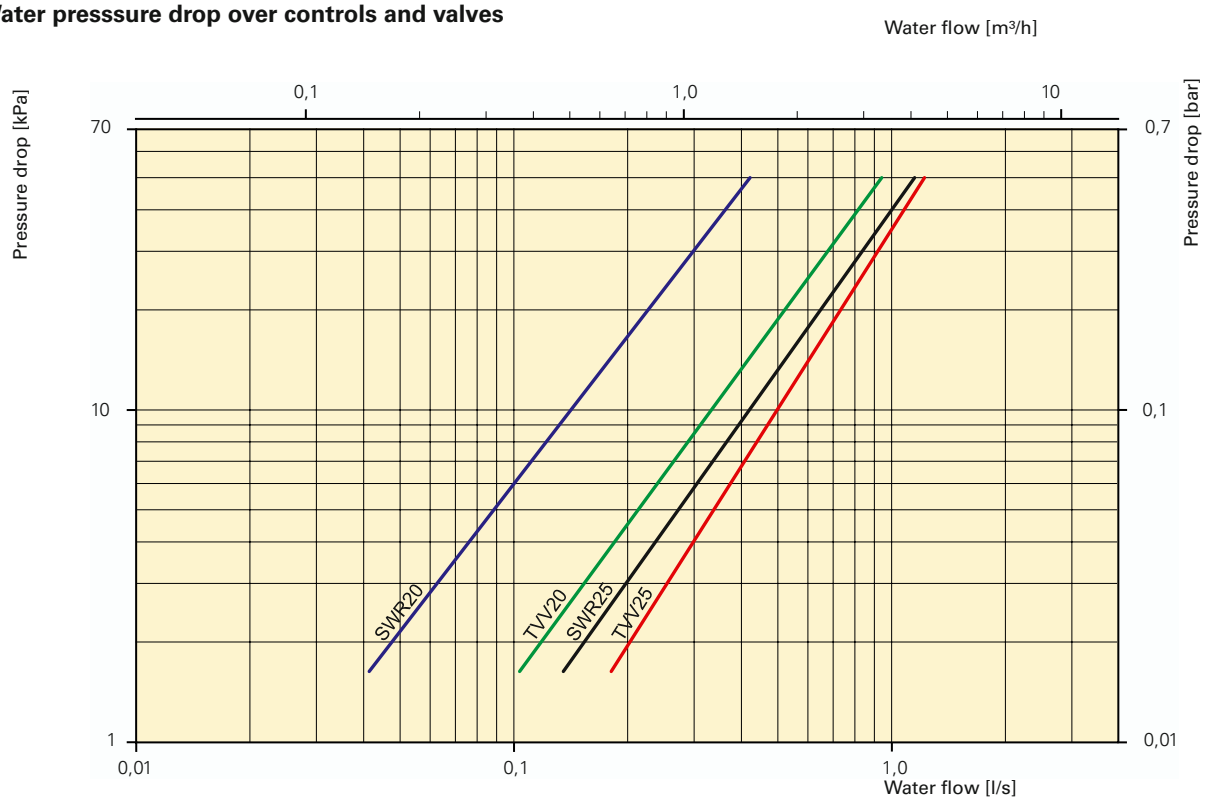
*) Air flow, air distribution and sound levels for all fan positions are shown on page 102.

Note! All specifications are shown for SW without accessories. With filter section, air flow and output are reduced.
In the tables for air flow and air distribution on page 102, air flow data for SW with accessories is shown.

Pressure drop water



Water presssure drop over controls and valves



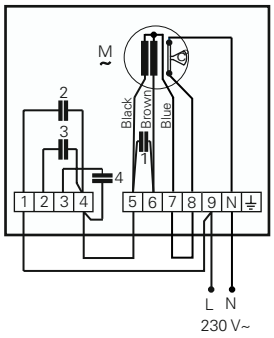
The pressure drop is calculated for an average temperature of 70 °C (PVV 80/60).
For other water temperatures, the pressure drop is multiplied by the factor K.

Average temp water °C	40	50	60	70	80	90
K	1.10	1.06	1.03	1.00	0.97	0.93

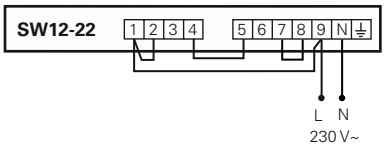
Wiring diagrams SW12 and SW22

Preset fan speed, no regulation

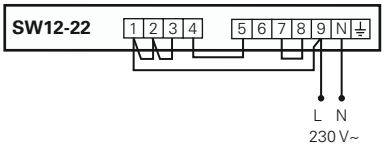
Connected for low speed, fan position 1



Connected for medium speed, fan position 2



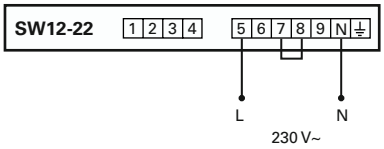
Connected for high speed, fan position 3



Capacitors in SW

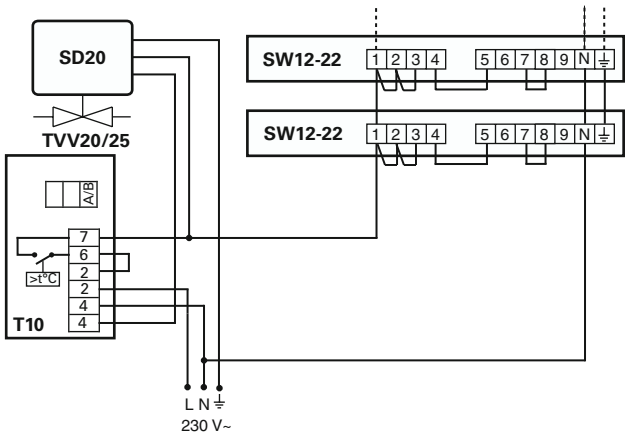
SW12				SW22			
1	2	3	4	1	2	3	4
4µF	8µF	2µF	2µF	8µF	16 µF	1µF	3µF

Connected for maximum speed, fan position max



Control by thermostat only

T10,
electronic
thermostat

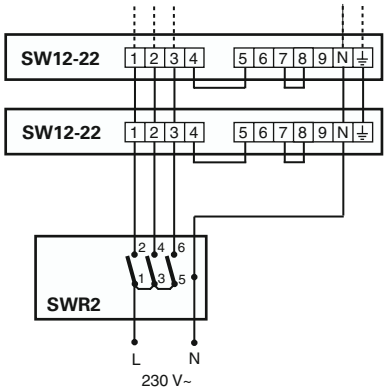


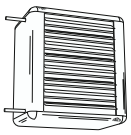
SD20, actuator

TVV20/25 two way
valve

3-step control of airflow only

SWR2,
3-step fan speed
control



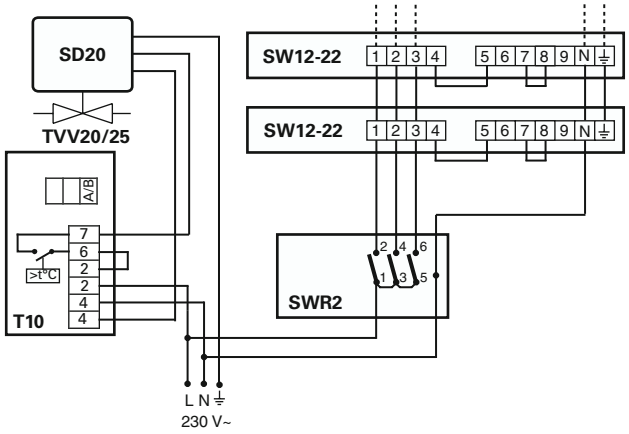


Wiring diagrams SW12 and SW22

Thermostat and 3-step control

T10,
electronic
thermostat

SWR2,
3-step fan speed
control



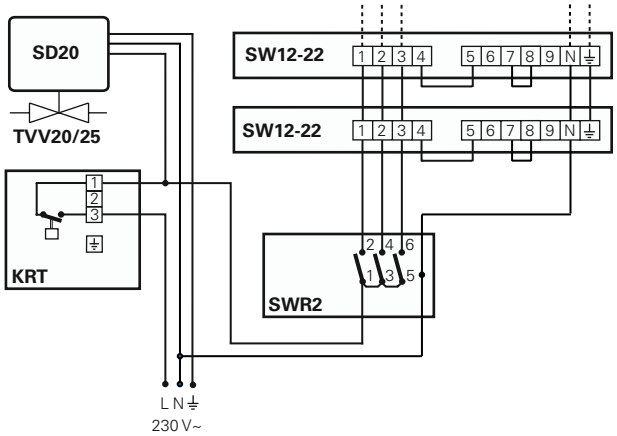
SD20, actuator

TVV20/25 two way
valve

Thermostat and 3-step control

KRT1900,
room thermostat

SWR2,
3-step fan speed
control

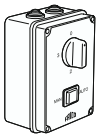


SD20, actuator

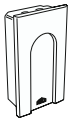
TVV20/25 two way
valve

Automatic temperature and airflow control

SWR1



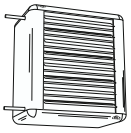
SWR,
control panel



RTI2,
electronic 2-step
thermostat

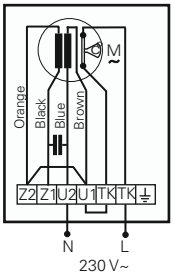
SD20, actuator

TVV20/25 two way
valve



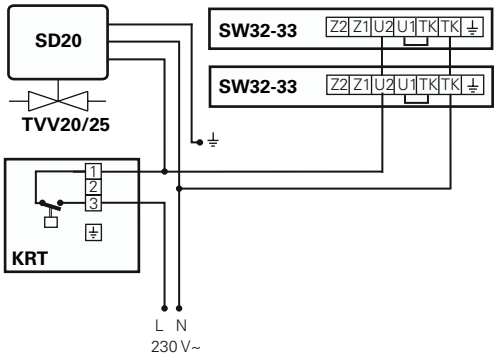
Wiring diagrams SW32 and SW33

Preset fan speed, no regulation



Control by thermostat only

KRT1900,
room thermostat

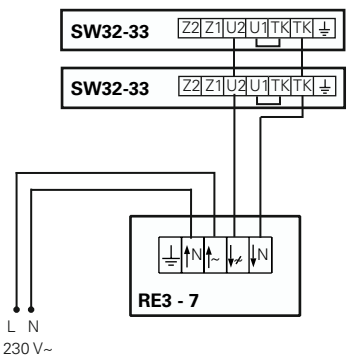


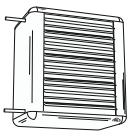
SD20, actuator

TVV20/25 two way
valve

5-step control of airflow only

RE3/RE7,
5-stage change-over
switch for air flow

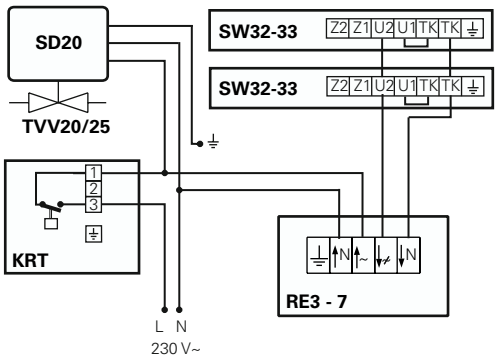




Thermostat and 5-step control

RE3/RE7,
5-stage change-over switch for air flow

KRT1900,
room thermostat



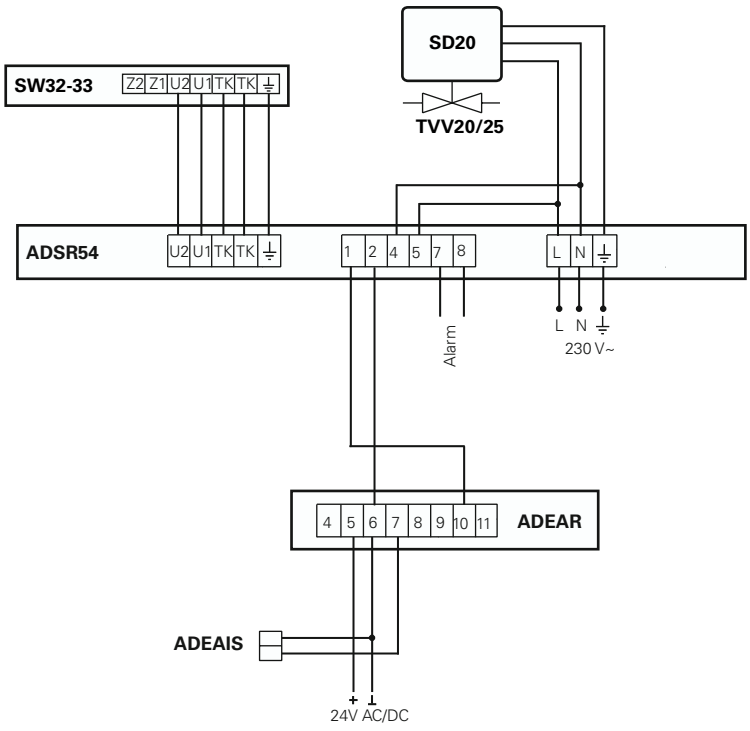
SD20, actuator

TVV20/25 two way valve

Automatic speed regulation

ADEAR, regulator with display unit and built-in room sensor

ADEAIS, external room sensor



SD20, actuator

TVV20/25 two way valve

ADSR54
stepless fan speed control

Diameter: 1.4 meter CE

Industrial ceiling fan ICF

Equalizes the temperature in buildings with high ceilings

Application

Ceiling fans are used primarily to equalize the temperature in rooms with high ceilings, such as industrial and warehouse buildings, gymnasiums, and shops. Several controls as well as downrods and blades of different sizes are available, making it possible to adapt ceiling fan ICF to almost all applications.

Comfort

Warm air is lighter than cold air and therefore rises towards the ceiling. In buildings with high ceilings, a cushion of warm air builds under the ceiling. Ceiling fan ICF pushes down the heated air at a low speed. In this way, the heat is better utilised in the occupied zone without draughts. Ceiling fan ICF can rotate in both ways, an advantage when installed at a low height.

Operation and economy

Ceiling fan ICF pushes the warm air from the ceiling and thus lowers the temperature there, the heat losses through the roof and walls are reduced and in many cases, heating costs can be reduced by up to 30%.

Ceiling fan ICF is a high quality, maintenance free product with long lifetime, which results in a very short pay-off time, that is often less than one year.

Design

Industrial ceiling fan ICF has a functional design and white colour which blends well in most premises. The low sound level makes it even more discreet.

Product specifications

- The blades push down large volumes of air without causing excessive air speed.
- Can operate clockwise and anti-clockwise.
- Canopy with vibration absorption.
- The enclosed motor is equipped with permanently lubricated ball bearings for long life.
- Other fan blade diameters are available as an accessory (914, 1218 mm).
- Other downrods are available as an accessory (gives a total height of 395, 945 mm).
- High protection class, IPX5 (ICF55).
- Fan blades and downrod coated with zinc.
- Colour: NCS S 0505-R90B

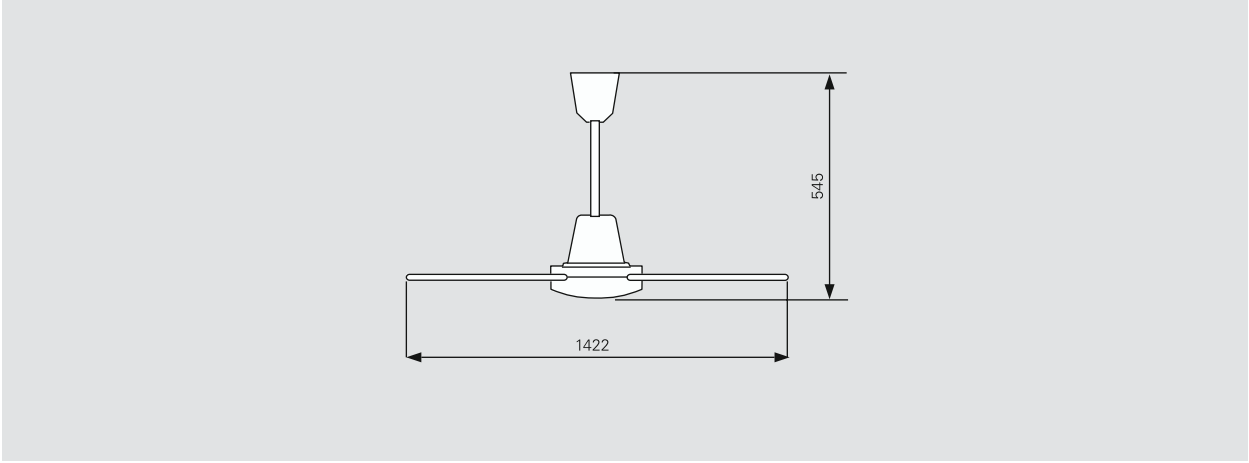
Reduces heat losses with up to 30 %.

Technical specifications | Ceiling fan ICF

Type	Output [W]	Airflow [m³/h]	Voltage [V]	Amperage [A]	Height x Ø [mm]	Weight [kg]
ICF20	70	13500	230V~	0.33	545x1422	6.2
ICF55	70	13500	230V~	0.33	545x1422	6.2

Protection class ICF20: (IPX0), normal design.
Protection class ICF55: (IPX5), splash-proof design.
Approved by IMQ and CE compliant.

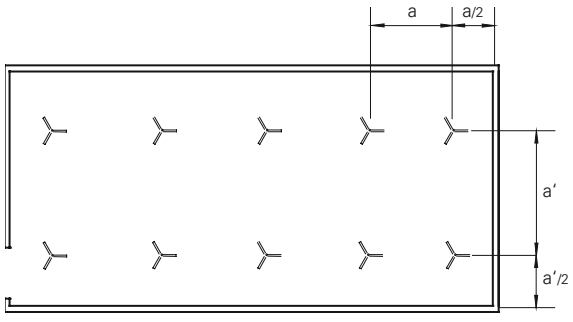
Dimensions

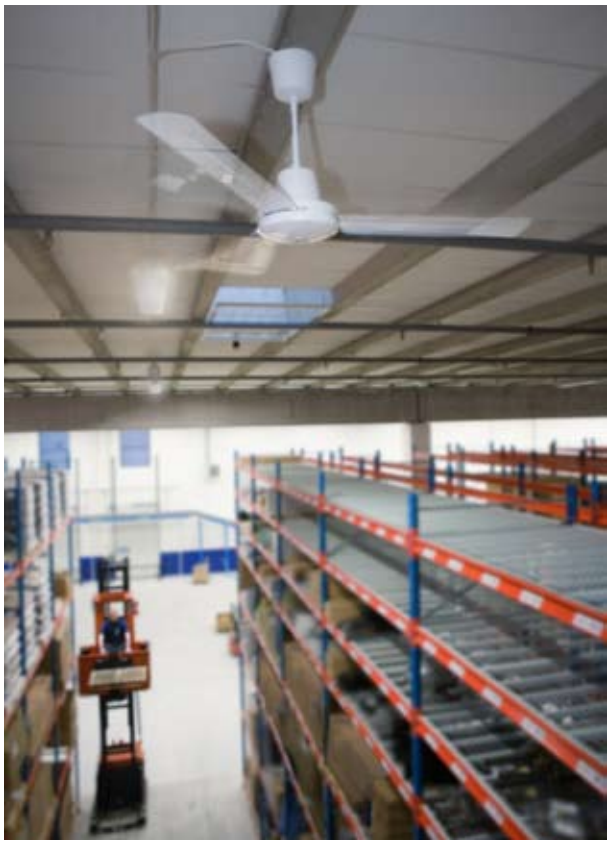


Mounting and connection

The fans are positioned systematically in the room at equal distances between themselves as detailed in the table below. This is to give the best temperature distribution. To adapt the fan to suit each specific room it should be controlled with a fan speed regualtor.

Recommended distance between fans					
Ceiling height [m]	4	6	8	10	12
Distance a [m]	5	7	8	9	10





Control options

The fan speed on ceiling fans should be controlled to obtain optimal heat equalization and prevent draughts.

The fan can be reversed for summer operation. CAR15 and CFR1R have this function, with other control options a change-over switch is needed. This switch is connected in a series after the control and a 4x1.5 mm² cable must be used.

- CAR15, automatic fan speed control, for maximum15 fans, reversible
- CFR1R, 5-step control for 1 fan, reversible
- RE5, 5-step control for a maximum of 12 fans
- PE1, variable fan speed control for a maximum of 2 fans
- PE2,5, variable fan speed control for a maximum of 6 fans

Accessories

CAR15

CFR1R

RE5

PE1/PE2,5

CAR15, automatic fan speed control
Automatic fan speed control, through external sensor, in accordance with variations in the temperature between the ceiling and the floor. Built-in switch for reversed rotation. Controls a maximum of 15 fans. IP33.

CFR1R, 5-step control
5-step control. Built-in switch for reversed rotation. Controls a maximum of 1 fan. IPX0.

RE5, 5-step control
5-step control. Controls a maximum of 12 fans. IP54.

PE1/PE2,5, variable fan speed control
Single-phase manual thyristor for variable speed adjustment of the fan and on/off regulation. External mounting (IP54) or recessed mounting (IP44). PE1 controls a maximum of 2 fans. PE2,5 controls a maximum of 6 fans.

CFAP200, short downrod
Gives the fan a total height of 395 mm.

CFAP750, long downrod
Gives the fan a total height of 945 mm.

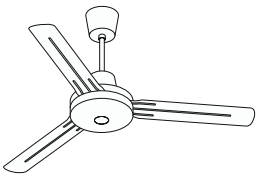
CFB900, fan blades
Gives the fan a diameter of 914 mm.
Complete set of 3 fan blades.

CFB1200, fan blades
Gives the fan a diameter of 1218 mm.
Complete set of 3 fan blades.

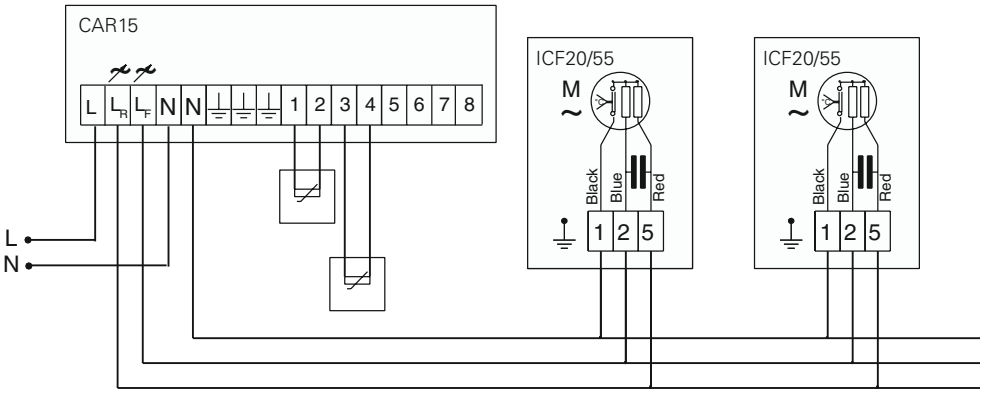
Type	Description	HxWxD [mm]
CAR15	Automatic fan speed control	210x210x100
CFR1R	5-step control for 1 fan	120x120x60
PE1	Variable fan speed control for 2 fans, external mounting (IP54) or recessed mounting (IP44)	82x82x65
PE2,5	Variable fan speed control for 6 fans, external mounting (IP54) or recessed mounting (IP44)	82x82x65
CAR15	Automatic fan speed control	210x210x100
RE5	5-step control for 12 fans	200x105x105
CFAP200	Short downrod, total height 395 mm	
CFAP750	Long downrod, total height 945 mm	
CFB900	Fan blades, fan diameter 914 mm	
CFB1200	Fan blades, fan diameter 1218 mm	

Wiring diagrams

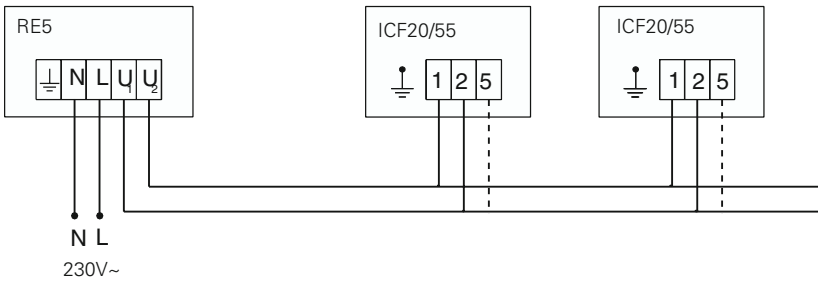
Wiring for fan speed control



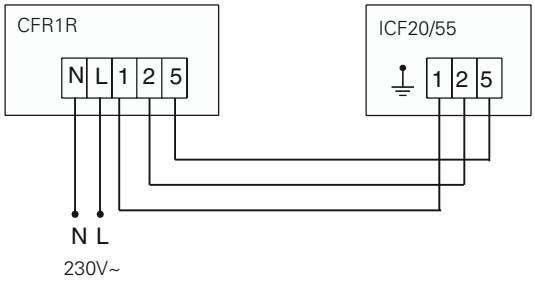
CAR15,
automatic
fan speed control



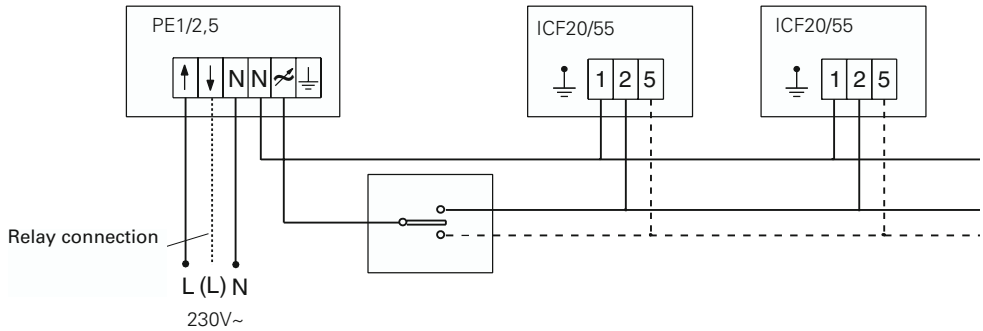
RE5,
5-step control



CFR1R,
5-step control



PE,
variable fan speed
control



Convectors

The rotary movement of air that forms in a room where the air is affected by a heat source is called convection. The air gets warm and rises then cools and returns to be heated again. Heat disperses in the room while the upward directed warm air stream is utilised to counteract cold draughts from windows for example.

Convectors and radiators are simple to install. Our range contains a convector to suit all needs: small, discreet, robust and hard-wearing or quick and economical, all with the same high level of quality.

Robust

Frico's ribbed pipe radiators are designed for harsh environments and are approved for wet rooms, but are also available in designs for rooms at risk of fire. The retro design has also created a new application area in modern housing.

Easy-to-place

Thermowarm is a series of easily installed convectors designed for public buildings such as changing rooms, stores and toilets. TWTC can also be used in corrosive and aggressive environments. TWT200 has a surface temperature as low as 60 °C, which makes it ideal for daycare centres and bathrooms.

Instant

Fan convector PF is suitable for most environments, for example, homes and offices. It is also ideal for use in buildings that are rarely used, for example, weekend cottages, where quick heating is required. The fan convector also has very good drying properties. Models up to 800 W have a surface temperature of less than 60 °C which makes them extremely suitable for daycare centres and bathrooms.

Compact

The mini radiator/frost guard gives off a lot of heat despite the small size. The compact radiators are suitable for providing frost protection, but can also be used to heat many different areas, for example, homes, close to water pipes, small warehouses, greenhouses and electrical cabinets.

Discret

Bench heater SH is designed for use with church pews, waiting room benches and the like. The bench heater is installed under the seat and distributes heat in the occupied zone through convection and radiant heat.

200–1150 W Electrical heat

9 models

CE

Ribbed pipe radiator

Robust and hard wearing ribbed pipe radiator in a retro design

Application

Frico's ribbed pipe radiators are designed for harsh environments and are approved for wet rooms, but are also available in designs for rooms at risk of fire. The retro design has also created a new application area in modern housing.

Comfort

Convectors and radiators from Frico efficiently produce pleasant heat. Heat distribution in the room is good at the same time as the warm air flow directed upwards can be used to counteract cold draughts from the windows.

Operation and economy

The possibility of choosing products with different outputs results in energy efficient heating irrespective of whether the whole building is to be heated or only frost protection is required. A long life and minimum maintenance also reduce costs.

Design

Frico's ribbed pipe radiators have a hard wearing and robust design in dark green sheet steel. The compact format means the radiator has a small footprint, but gives a lot of heat.

Product specifications

- The ribbed pipe radiator is available in the following designs:
  - **Model 125**, without output selector.
  - **Model 126**, with output selector that regulates the heat in three steps.
  - **Model 127**, without output selector, sand-filled and suitable for rooms at risk to fire.
- The ribbed flanges increase the heating surface and provide good heat transfer combined with a compact design.
- Approved for wet rooms (IP44).
- Resettable overheating protection along the full length of the ribbed pipe radiator.
- A protective steel case give a lower surface temperature and extra protection against impact (model 125 and 126).
- Can be regulated using an external thermostat.
- Colour: RAL 6005, NCS 7020-B90G (dark green).

The origins of Frico's ribbed pipe radiators can be traced back to the 1930s, but they are just as suitable, hard wearing and functional today.

The ribbed pipe radiator's design and mounting brackets make them easy to install, for example, below a window.

Robust and hard wearing — Frico's ribbed pipe radiators are ideal for harsh environments.

Installed by a window the ribbed pipe radiators effectively counteract cold draughts that frequently form by large glazed areas.

Technical specifications | Ribbed pipe radiator 125. Without output selector

Type	Output [W]	Voltage [V]	LxHxD [mm]	Weight [kg]
125-12B	200	230V~	370x180x185	2.4
125-22B	375	230V~	530x180x185	3.3
125-32B	575	230V~	730x180x185	4.5
125-42B	775	230V~	880x180x185	5.5

Technical specifications | Ribbed pipe radiator 126, with output selector.

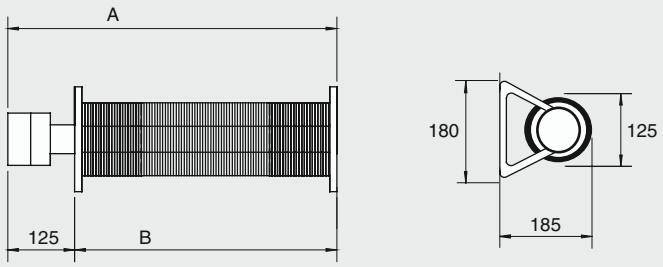
Type	Output [W]	Voltage [V]	LxHxD [mm]	Weight [kg]
126-32B	575	230V~	730x180x185	4.7
126-42B	775	230V~	880x180x185	5.7
126-52B	1150	230V~	1185x180x185	7.5

Technical specifications | Ribbed pipe radiator 127, without output selector, for use in combustible areas (sand filled)..

Type	Output [W]	Voltage [V]	LxHxD [mm]	Weight [kg]
127-22B	500	230V~	980x180x185	10.9
127-42B	800	230V~	1925x180x185	33.3

Protection class: IP44.
CE compliant.
Ribbed pipe radiators 125-32B, 125-42B and 126 are approved by Det Norske Veritas.

Dimensions



	A [mm]	B [mm]
125-12B	370	245
125-22B	530	405
125-32B	730	605
125-42B	880	755
126-32B	730	605
126-42B	880	755
126-52B	1185	1060
127-22B	980	855
127-42B	1925	1800

Mounting and connection

Mounting

The ribbed pipe radiator is installed horizontally on the wall with the connection box to the left seen from the front. For minimum dimensions with permanent installation, see diagram 1.

Electrical installation

The ribbed pipe radiator is intended for permanent installation.

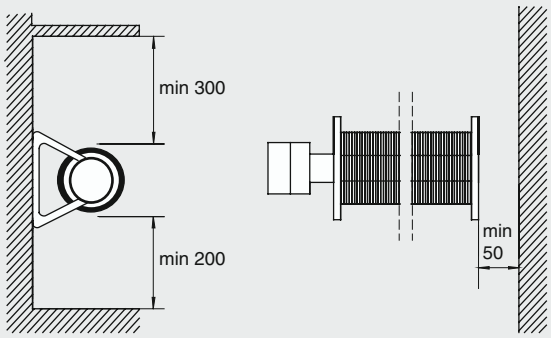
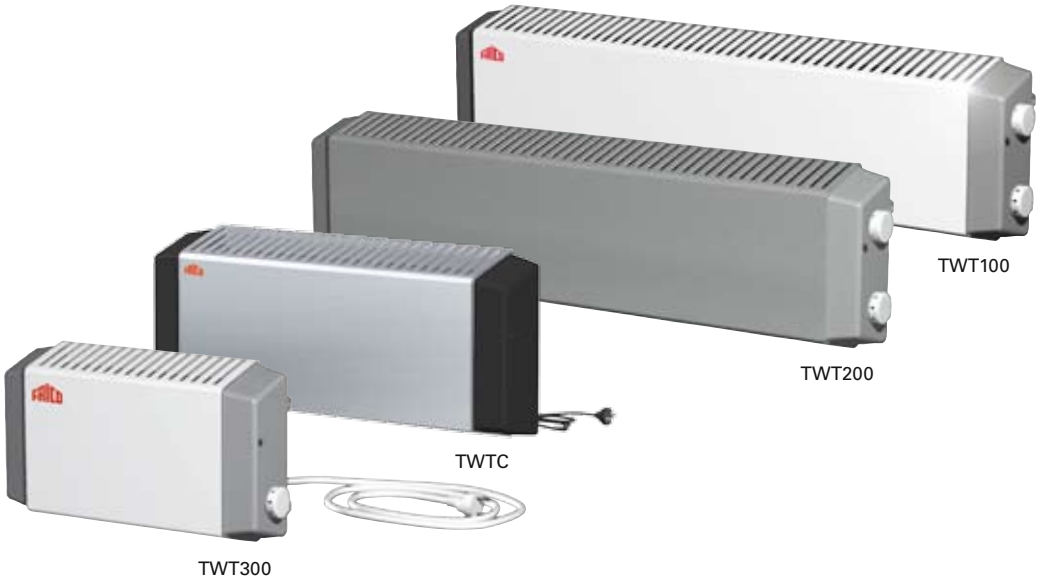


Fig. 1: Minimum distance for fixed installation.

Controls

The ribbed pipe radiator is can be regulated using an external thermostat. Model 126 features an integrated output selector that regulates the heat in three steps (0-1/3-2/3-1). For further options, see section on thermostats and controls or contact Frico.



300-1000 W Electrical heat

18 models

Thermowarm

Easily positioned convector in several different designs

Application

Thermowarm is a series of easily installed convectors designed for public buildings such as changing rooms, stores and toilets. TWTC can also be used in corrosive and aggressive environments. TWT200 has a surface temperature as low as 60 °C, which makes it ideal for daycare centres and bathrooms.

Comfort

Convectors and radiators from Frico efficiently produce pleasant heat. Heat distribution in the room is good at the same time as the warm air flow directed upwards can be used to counteract cold draughts from the windows.

Operation and economy

The possibility of choosing products with different outputs results in energy efficient heating irrespective of whether the whole building is to be heated or only frost protection is required. A long life and minimum maintenance also reduce costs.

Design

Thermowarm is easy to position and has, despite its small size, a large heat output. The three different surface finishes: white, grey covered panel covered and stainless steel, make Thermowarm suitable for most environments. The front cover can be opened making it straightforward to keep the convectors clean and tidy.

Product specifications

- Thermowarm is available in four designs:
  - **TWT100:** white front, RAL 9016, NCS0500, and grey sides. Equipped with circuit breaker. IP44.
  - **TWT200:** grey covered front panel and grey sides. Equipped with circuit breaker, surface temperature 60 °C. IP44.
  - **TWT300:** white front, RAL 9016, NCS0500 and grey sides, with mains cord and plug. IP21.
  - **TWTC:** stainless steel design and black sides. Equipped with mains cord and plug. Concealed temperature setting. IP54.
- With ribbed flanges and tubular elements.
- Integrated thermostat with setting range 0 – +35 °C.
- Resettable overheating protection along the full length of the convector.
- Ends of impact resistant thermoplastic.

The small size and effortless installation make Thermowarm easy to position even in confined areas such as a control cabin.

In the stainless steel design Thermowarm withstands corrosive environments.

The grey covered front panel gives a low surface temperature and TWT200 is therefore recommended for .e.g. bathrooms.

Thermowarm is available with a white front, with or without a circuit breaker.

Technical specifications | Thermowarm TWT100. White front, with switch

Type	Output [W]	Voltage [V]	HxWxD [mm]	Weight [kg]
TWT10321	300	230V~	345x205x123	1,5
TWT10331	300	400V~	345x205x123	1,5
TWT10521	500	230V~	465x205x123	2,0
TWT10531	500	400V~	465x205x123	2,0
TWT11021	1000	230V~	765x205x123	3,0
TWT11031	1000	400V~	765x205x123	3,0

Technical specifications | Thermowarm TWT200. Grey covered front, with switch. Max surface temperature of 60 °C

Type	Output [W]	Voltage [V]	HxWxD [mm]	Weight [kg]
TWT20321	300	230V~	345x205x123	1,5
TWT20331	300	400V~	345x205x123	1,5
TWT20521	500	230V~	465x205x123	2,0
TWT20531	500	400V~	465x205x123	2,0
TWT21021	1000	230V~	765x205x123	3,0
TWT21031	1000	400V~	765x205x123	3,0

Technical specifications | Thermowarm TWT300. White front, with cable and plug.

Type	Output [W]	Voltage [V]	HxWxD [mm]	Weight [kg]
TWT30321	300	230V~	345x205x123	1,5
TWT30521	500	230V~	465x205x123	2,0
TWT31021	1000	230V~	765x205x123	3,0

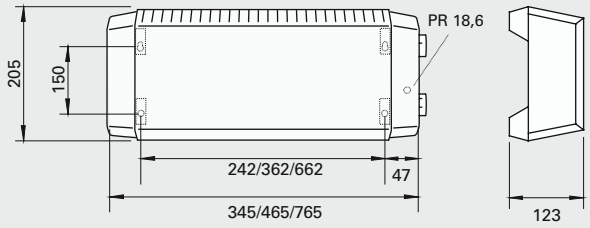
Technical specifications | Thermowarm TWTC. Front in stainless steel, with cable and plug.

Type	Output [W]	Voltage [V]	HxWxD [mm]	Weight [kg]
TWTC30321	300	230V~	345x205x123	1,5
TWTC30521	500	230V~	465x205x123	2,0
TWTC31021	1000	230V~	765x205x123	3,0

Protection class TWT100 and TWT200: IP44.
Protection class TWT300: IP21.
Protection class TWTC: IP54.

CE compliant.

Dimensions



Mounting and connection

Mounting
Thermowarm is mounted on a wall. For minimum dimensions with permanent installation, see diagram 1.

Electrical installation
TWT100/200 is designed for permanent installation. TWT300 and TWTC are equipped with a mains cord and plug for connection to earthed outlet sockets.

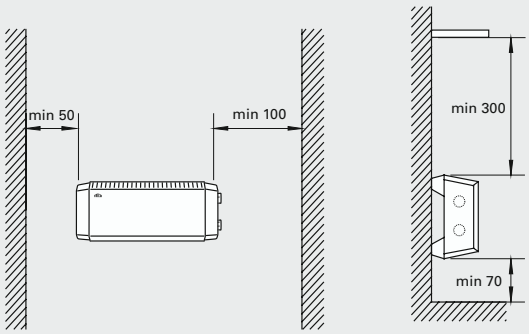


Fig. 1: Minimum distance for fixed installation.

Controls

Thermowarm features an integrated thermostat with setting range 0 – +35 °C. On TWTC the thermostat is concealed to make it difficult for unauthorised persons to change the temperature setting. TWT100/200 has a circuit breaker. For further options, see section on thermostats and controls or contact Frico.

Electrical heat

Water heat

3 models

Fan convector PF

Efficient fan convector for quick heating

Application

Fan convector PF is suitable for most environments, for example, homes and offices. It is also ideal for use in buildings that are rarely used, for example, weekend cottages, where quick heating is required. The fan convector also has very good drying properties. Models up to 800 W have a surface temperature of less than 60 °C which makes them extremely suitable for daycare centres and bathrooms.

Comfort

Convectors and radiators from Frico efficiently produce pleasant heat. The fan in the PF means that a balanced temperature throughout the room is obtained very quickly. The upward directed air flow can also be used to counteract cold draughts from e.g. windows.

Operation and economy

The fan convector consumes less energy than standard convectors. The air flow from the convector, which balances the temperature difference between the floor and ceiling, gives higher efficiency and lower energy consumption compared to convectors without a fan.

Design

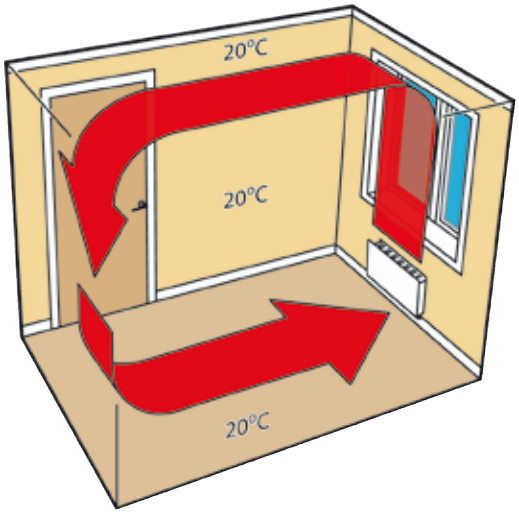
Fan convector PF has an attractive and clean design in a white finish. A brushed aluminium front is available as an accessory. The low surface temperature makes it possible to finish the front panel in any colour or a film finish can be applied.

Product specifications

- Fan convector PF is available in the following designs:
  - **PFE** is equipped with a 1.2 metre long cord with plug for connection to an earthed outlet socket (230V~). Can be used as a portable unit, a floor stand is available as an accessory.
  - **PFD** is designed for permanent installation (400V2~).
  - **PFW** is for water based heating. Equipped with a 1.2 metre long cord with plug for connection to an earthed outlet socket. Supplied with two, 0.9 m PEX hoses for easy installation. Works with a heat pump.
- Low sound level.
- The air intake is protected by a metal filter which prevents e.g. dust from entering the radiator.
- Master/slave function (PFE/PFD).
- Integrated thermostat with setting range 5 – +35 °C (PFE/PFD).
- Prepared for night tariffs via external signal (PFE/PFD).
- Corrosion proof housing made of hot zinc-plate and powder enameled steel panels. Colour: RAL 9016, NCS 0500 (standard). A brushed aluminium front is available as an accessory.

Fan convector PF has very good drying properties and is therefore ideal for use in bathrooms.

The low surface temperature makes it possible to finish the front panel in any colour.



The rotating air flow created by the fan convector makes it particularly suitable in areas that require quick heating.

Clean, attractive design and low sound level - fan convector PF is unobtrusive.

Technical specifications | Fan convector PFE electrically heated, with cord and plug.

Type	Output [W]	Voltage [V]	Amperage [A]	LxWxD [mm]	Weight [kg]
PFE5	500	230V~	2,3	598x330x90	6,0
PFE8	800	230V~	3,6	598x330x90	6,0
PFE10	1000	230V~	4,4	598x330x90	6,0
PFE12	1200	230V~	5,3	598x330x90	6,0

Technical specifications | Fan convector PFD electrically heated, for fixed installation.

Type	Output [W]	Voltage [V]	Amperage [A]	LxWxD [mm]	Weight [kg]
PFD5	500	400V2~	2,3	598x330x90	6,0
PFD8	800	400V2~	3,6	598x330x90	6,0
PFD10	1000	400V2~	4,4	598x330x90	6,0
PFD12	1200	400V2~	5,3	1058x330x90	6,0

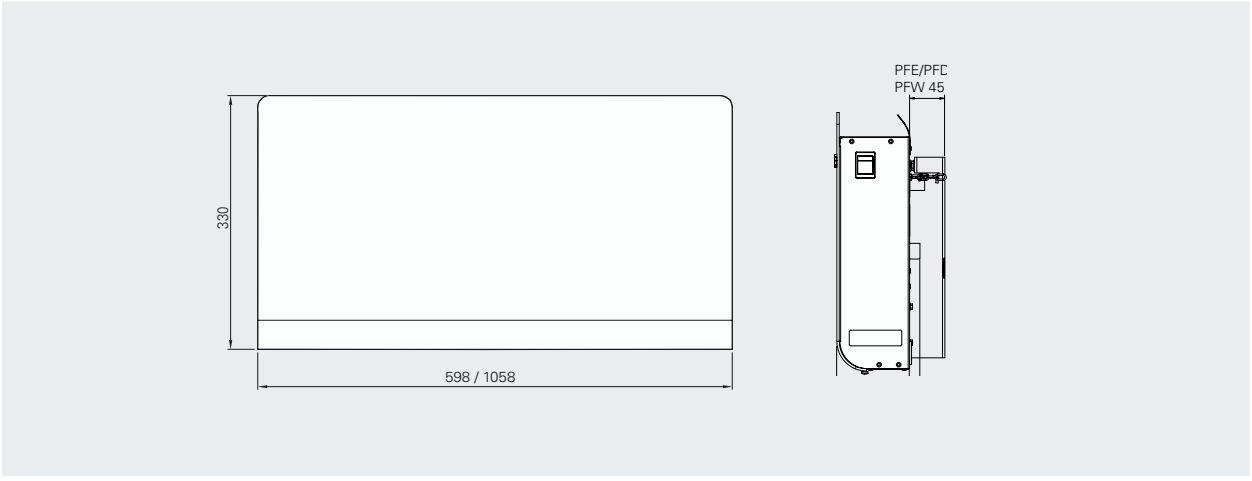
Technical specifications | Fan convector PFW water heated.

Type	Output*[1] [W]	Air flow [m³/h]	Soundlevel*[2] [dB(A)]	Voltage [V]	Amperage [A]	LxWxD [mm]	Weight [kg]
PFW10	1,1	59/48	42/32	230V~	0,15/0,07	598x330x90	7,3
PFW20	3,0	165/78	44/33	230V~	0,31/0,13	1058x330x90	12,8

*[1]) Applicable at water temperature 80/60 °C, air temperature, in +20 °C.
*[2]) Conditions: Distance to the unit 3 metres. Directional factor: 2. Equivalent absorption area: 50 m².

Protection class: IP23.
Approved by SEMKO and CE compliant.

Dimensions



Mounting and connection

Mounting
Fan convector PF is mounted on the wall. For minimum dimensions with permanent installation, see diagram 1. PFE can also be used as a portable unit; a floor stand is available as an accessory.

Electrical installation
PFE and PFW are equipped with a 1.2 metre long cord with plug for connection to an earthed outlet socket. PFD is intended for permanent installation.

Water connection
The connection is made using flexible hoses (two, 0.9 m PEX hoses). Connection dimensions DN15 (1/2"), male thread.

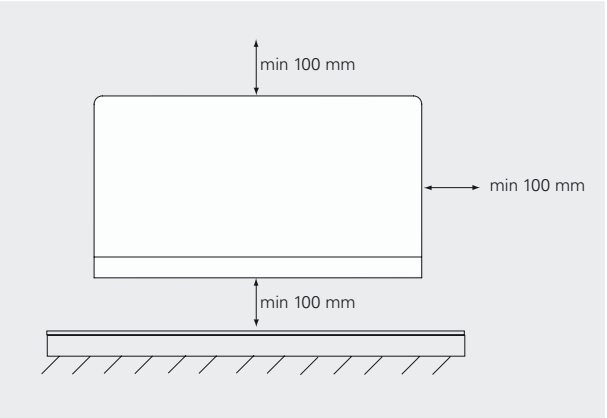


Fig. 1: Minimum distance for fixed installation.

Controls

PFE/PFD features an integrated electronic thermostat with setting range +5 – +35 °C. The fan speed (low/high) can be set on PFW. Electric convectors are prepared for night tariffs via external signal. When installing several electrically heated units, one unit can be used as the master while other units are connected as slaves.

Output charts water

			Incoming / outgoing water temperature							
			Incoming air temp.= +20 °C							
Type	**Fan position**	**Airflow [m³/h]**	**Output [kW]**	**Outgoing air temp. [°C]**	**Water flow [l/s]**	**Pressure drop [kPa]**	**Output [kW]**	**Outgoing air temp. [°C]**	**Water flow [l/s]**	**Pressure drop [kPa]**
			Incoming / outgoing water temperature 80/60 °C				**Incoming / outgoing water temperature 70/50 °C**			
PFW10	max	59	1,09	74	0,01	0,7	0,88	64	0,01	0,6
	min	48	0,90	75	0,01	0,5	0,74	65	0,01	0,4
PFW20	max	165	3,00	73	0,03	7,1	2,44	63	0,02	5,1
	min	78	1,52	77	0,01	2,1	1,25	67	0,01	1,6
			Incoming / outgoing water temperature 60/40 °C				**Incoming / outgoing water temperature 60/30 °C**			
PFW10	max	59	0,67	53	0,01	0,3	0,54	47	0,01	0,1
	min	48	0,56	55	0,01	0,2	0,46	48	0,01	0,1
PFW20	max	165	1,87	53	0,02	3,2	1,55	47	0,01	1,2
	min	78	0,97	57	0,01	1,0	0,85	52	0,01	0,4
			Incoming / outgoing water temperature 55/45 °C				**Incoming / outgoing water temperature 55/35 °C**			
PFW10	max	59	0,64	52	0,01	1,1	0,56	48	0,01	0,3
	min	48	0,53	52	0,01	0,8	0,47	49	0,01	0,2
PFW20	max	165	1,77	51	0,04	10,3	1,57	48	0,01	2,4
	min	78	0,89	53	0,02	3,0	0,83	51	0,01	0,8

Accessories

Type	Description
PFFAL	Front, brushed aluminium (not PFW20)
PFFS	Floor stand for PFE

200–450 W Electrical heat

4 models

Mini radiator/Frost guard

Compact mini radiator for frost protection and heating

Application

The mini radiator/frost guard gives off a lot of heat despite the small size. The compact radiators are suitable for providing frost protection, but can also be used to heat many different areas, for example, homes, close to water pipes, small warehouses, greenhouses and electrical cabinets.

Comfort

Convectors and radiators from Frico efficiently produce pleasant heat. Heat distribution in the room is good at the same time as the warm air flow directed upwards can be used to counteract cold draughts from the windows.

Operation and economy

The possibility of choosing products with different outputs results in energy efficient heating irrespective of whether the whole building is to be heated or only frost protection is required. A long life and minimum maintenance also reduce costs.

Design

The mini radiator/frost guard is available in white or stainless steel designs and is very easy to position on account of its small size.

Product specifications

- Mounted horizontally (FML/FMLR) or vertically (FMS) on the wall.
- Stainless steel tubular element.
- Equipped with 1 metre long cord with plug for connection to an earthed outlet socket.
- Integrated overheating protection.
- Integrated thermostat with setting range +5 – +35 °C.
- Colour front: NCS 1103-Y06R (white). FMLR200 has a stainless steel design.

Technical specifications | Mini radiator FML. White front.

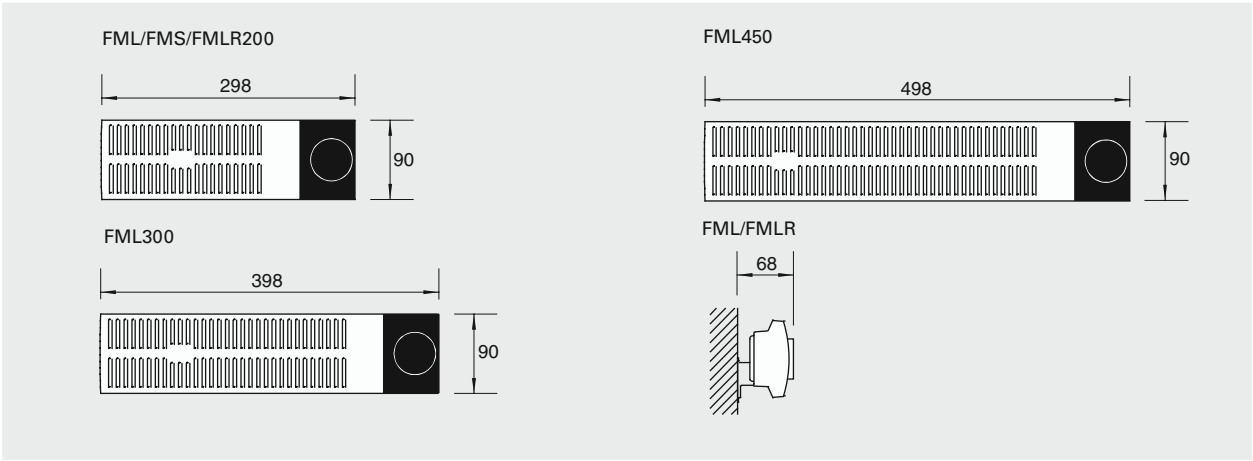
Type	Output [W]	Voltage [V]	LxHxD [mm]	Weight [kg]
FML200	200	230V~	298x90x68	0,7
FML300	300	230V~	398x90x68	0,9
FML450	450	230V~	498x90x68	1,1
FMS200	200	230V~	90x298x68	0,7

Technical specifications | Mini radiator FMLR. Stainless steel design.

Type	Output [W]	Voltage [V]	LxHxD [mm]	Weight [kg]
FMLR200	200	230V~	298x90x68	0,7

Protection class: IP31.
CE compliant.

Dimensions



Mounting and connection

Mounting

Frost guard FML/FMLR is wall mounted in a horizontal position with the knob on the right hand side. FMS is mounted in a vertical position. For minimum distance for fixed installation, see Fig. 1.

Connection

All models are equipped with 1 metre cable and plug for connection to an earthed wall socket.

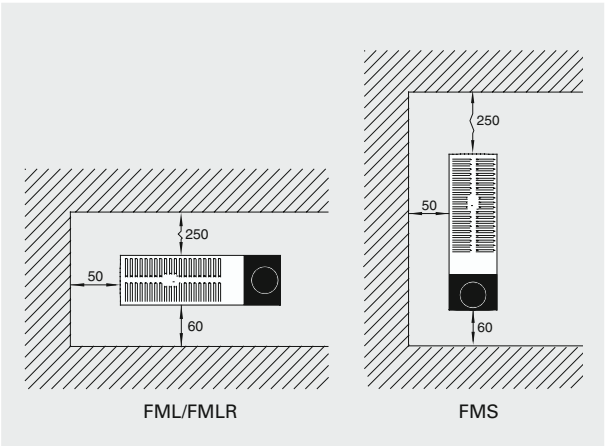


Fig. 1: Minimum distance for fixed installation.

Controls

FML/FMLR/FMS has a built-in thermostat with setting range +5 °C up to +35 °C.

175–375 W Electrical heat

6 models

Bench heater SH

Bench heater for good heating comfort in churches etc.

Application

Bench heater SH is designed for use with church pews, waiting room benches and the like. The bench heater is installed under the seat and distributes heat in the occupied zone through convection and radiant heat.

Comfort

The heaters are dimensioned to produce a pleasant heat on the actual seat surface and to the surroundings. In churches visitors experience good heating comfort, at the same time as power consumption and drying of inventories is kept to a minimum.

Operation and economy

As heat is produced as soon as the heater is switched on, SH is also an ideal and efficient option in slowly heated buildings such as churches. Only heating the building when necessary helps to keep down heating costs.

Design

Bench SH has a discreet design especially adapted to fit under benches and seats.

Product specifications

- Dual reflectors (external and internal) give downward heat dispersion.
- Approved for serial connection.
- Brackets for mounting are included.
- Equipped with protecion grille and tube element of stainless steel.
- Outer reflector is of zinc-plated steel panels and the heater is grey lacquered. Colour: NCS 4000, RAL 7036 (grey).

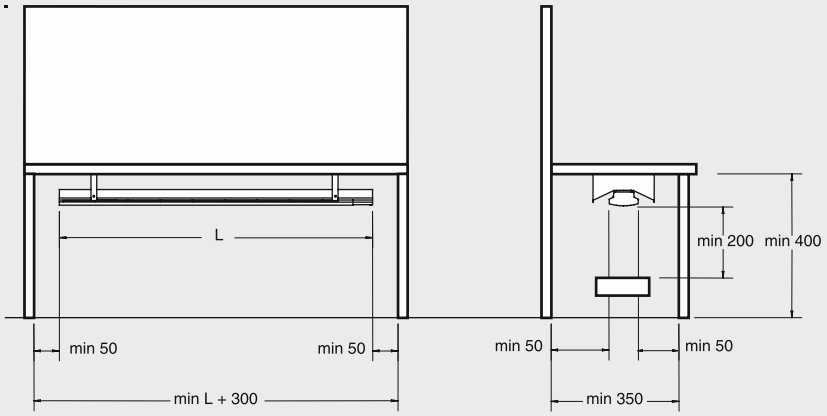
Technical specifications | Bench heater SH

Type	Output [W]	Voltage [V]	Amperage [A]	LxH*xW [mm]	Weight [kg]
SH17521	175	230V~	0,8	700x110x200	1,4
SH17531	175	400V~	0,4	700x110x200	1,4
SH25021	250	230V~	1,1	1000x110x200	1,9
SH25031	250	400V~	0,6	1000x110x200	1,9
SH37521	375	230V~	1,6	1500x110x200	2,9
SH37531	375	400V~	0,9	1500x110x200	2,9

*) With brackets

Protection class: IP21.
CE compliant.

Dimensions



	L [mm]
SH17521	700
SH17531	700
SH25021	1000
SH25031	1000
SH37521	1500
SH37531	1500

Minimum distance for fixed installation.

Mounting and connection

Mounting
Bench heater SH is installed horizontally underneath benches. For minimum dimensions with permanent installation, see the diagram above.

Electrical installation
Bench heater SH is intended for permanent installation and is approved for through-wiring. Connection and serial connection of SH is done with a maximum cable of 4x2.5 mm² + earth.

Controls

A programmable electric heating regulator should be used to control heating in churches and similar premises. The premises can be divided up into temperature zones, which are individually regulated and adapted to the characteristics of the building and the comfort of the visitors. For further options, see section on thermostats and controls or contact Frico.

2125 W Electrical heat

1 model

CE

Hand dryer HD2C

Hand dryer of modern design in stainless steel

Application

HD2C is a hand dryer of modern design in stainless steel intended to be installed in public sanitary areas such as rest rooms and dressing rooms. No paper towel waste and the premises are kept nice and clean.

Comfort

The fast and comfortable heat in the powerful air stream dries the hands efficiently.

Operation and economy

HD2C is easy to install and to use. When the built-in photocell detects the user's hands, the hand dryer starts automatically and stops a few seconds after the removal of the hands.

To use the HD2C is economical. The cost for the energy is only a small part of the cost of buying and handling paper towels.

Design

Hand dryer HD2C has a stainless steel housing of modern design and is easy to keep clean. The rounded top makes it impossible to put objects on the hand dryer.

Product specifications

- High airspeed and high output gives a short drying time.
- Built-in thermocontact with automatic reset protects from overheating.
- HD2C starts when the user's hands are 5-10 cm under the appliance (photocell with adjustable sensitivity). Stops 2-3 s after the hands' removal.
- Solid housing in 1.2 mm stainless steel.

Technical specifications | Handdryer HD2C

Type	Heat output [W]	Airflow [m³/h]	Airspeed [m/s]	Δt*¹ [°C]	Voltage [V]	Amperage [A]	Dimensions HxWxD [mm]	Weight [kg]
HD2C	2125	150	28	43	230V~	9.2	322x260x148	4.0

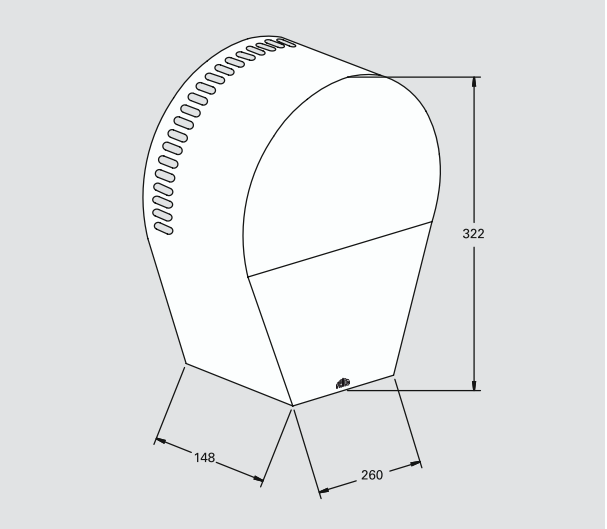
*¹) Δt = temperature rise of passing air at maximum heat.

Protection class: IPX3.
CE compliant.

Function

The hand dryer starts when the user's hands are 5-10 cm below the unit. The sensitivity of the photocells is adjusted using the potentiometer. The hand dryer stops 2-3 seconds after the hands are removed.

Dimensions



Mounting and connection

Mounting

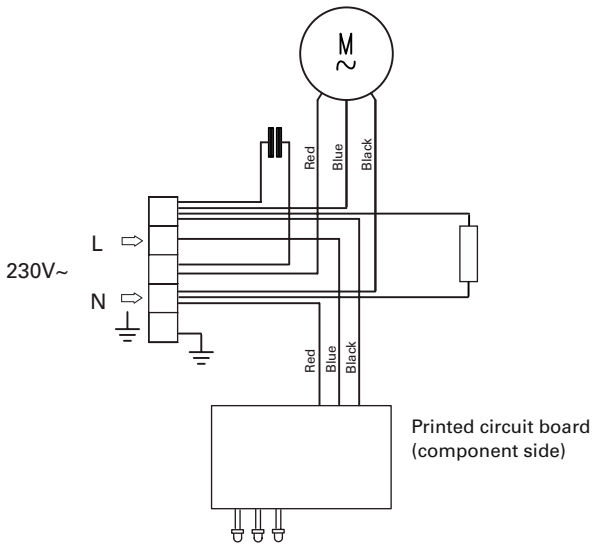
Handdryer HD2C is intended for wall mounting.
The unit should be placed with the air outlet facing downwards.

Electrical installation

Handdryer HD2C is intended for permanent installation.

Wiring diagrams

Internal wiring diagram



1 model CE

Dehumidifier LAF10

Compact and efficient dehumidifier for a better indoor climate

Application
LAF10 is a dehumidifier that reduces surplus moisture at the same time as it provides additional heat to the room. The dehumidifier is also ideal for use in areas frequently exposed to moisture, for example, basements, warehouses, washrooms, and sports halls or after minor water damage.

Comfort
The dehumidifier LAF10 contributes towards a comfortable and healthy indoor climbing. Indoor air with too high a moisture content can result in damage and discolouration to the building structure and interior. Bacteria and mould develop in moist air, which results in unhealthy and bad odours that also increase the risk of allergies.

Operation and economy
LAF10 is very easy to use and has low power consumption. With a controlled humidity you reduce the risk of moisture damage indoors that can be expensive to repair.

Design
With its straightforward design and neutral finish, LAF10 is suitable for most environments. Its castors and carrying handle make it easy to move and place.

Product specifications
- Low sound level.
- Dehumidifying capacity:
  5 litres/day at the condition RT 27 °C, RH 60 %.
  10 litres/day at the condition RT 30 °C, RH 80 %.
- Inbuilt filter.
- Automatic defrosting.
- Inbuilt collection container with level guard and indicator lamp.
- Outlet for drainage hose (6 mm).
- Adjustable hygrostat (30-80 % relative humidity).
- Two fan speeds.
- Equipped with a 2 metre long cord with plug for connection to an earthed outlet socket.
- ABS-plastic casing. Colour: Pantone 428C (white).

Technical specifications | Dehumidifier LAF10.

Type	Power consumption*1	Air flow	Sound level*2	Operating ambient humidity range	Operating temperature range	Voltage	Amperage*1	HxWxD	Weight
	[W]	[m³/h]	[dB(A)]	[% RH]	[°C]	[V]	[A]	[mm]	[kg]
LAF10	220	90/115	40/45	30-80	8-35	230V~	1,0	550x270x364	13,5

*1) Applicable at air temperature +20 °C.
*2) Conditions: Distance to unit: 3 metres.

Capacity (litres/day)

Type	At 30 °C 80% RH	At 27 °C 60% RH	At 20 °C 60% RH	At 8 °C 60% RH
LAF10	10,0	5,0	4,0	1,8

Water container volume: 4,0 l.
Refrigerant type (Freon-free): R134a.
Protection class: IP21.
Approved by TÜV and CE compliant.

Mounting and connection

Mounting
Dehumidifier LAF10 is portable.

Electrical installation
Dehumidifier LAF10 is equipped with a 2 metre long cord with plug for connection to an earthed outlet socket.

Controls
The required air humidity is set using the inbuilt hygrostat (30-80 % relative humidity). The fan speed (low/high) is easily selected on the unit.

Function
LAF10 works to lower the air humidity to the set level. Higher room temperatures give a better effect. When the water container (4 litres) is full and needs to be emptied a status lamp comes on and the dehumidifier stops. There is also the option to connect a drainage hose (6 mm inside diameter) and lead off the water directly to a drain.

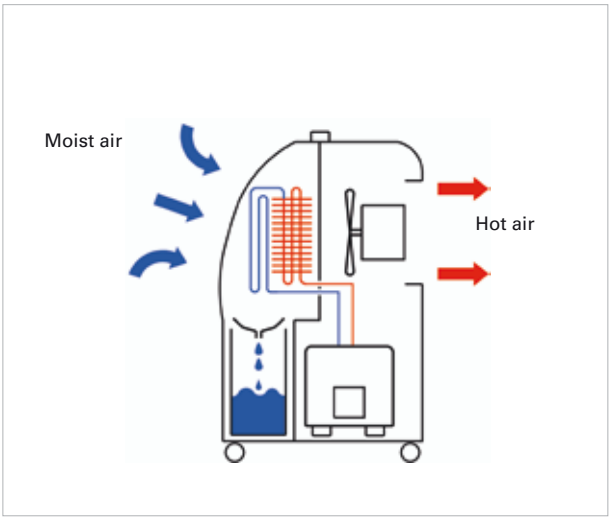


Fig. 1: Outline diagram LAF10.

Thermostats

Wide range of thermostats for all environments

CE

Application

Frico's thermostats create great comfort and save energy in public and commercial premises as well as in home environments. They control electrical and water borne floor heating, heat pumps, direct effect electric radiators/convectors and air conditioning. They are also extremely suitable for use with electrically or water heated radiant heaters, fan heaters and air curtains. We offer everything from processor controlled wireless thermostats with advanced functions to the simplest bimetal thermostats.

Comfort

Our precise thermostats create an even temperature and good indoor environment. Processor controlled thermostats also offer many variable functions in the same thermostat. A great advantage is the opportunity to control room and floor heating in integration. By limiting the temperature (min/max) of the floor heating, one has a pleasant floor temperature regardless of the season or selected room temperature.

Operation and economy

The thermostats can be used to control either slow systems such as floor heating or faster systems such as electric radiators/convectors. Correct control gives a longer life of the system and lower energy consumption. Precise thermostats provide economical heating. With save reduction and weekly program functions one can choose to have lower temperatures, for example at night to give further savings.

Design

Timeless and discreet design, which blends in with all environments.

Product specifications – functions within the range*:

- Digital display for exact setting and reading off.
- Internal and/or external sensors. Possibility of selecting the sensor function and limiting external sensors (min/max).
- Save reduction.
- Possible to control heating or cooling.
- Protection class up to IP55.
- On/off control (for slow systems) or proportional control (for faster systems) in the same thermostat.
- Temperature range down to -35 °C.

*) See following pages for detailed information or separate product sheet/manual.


T10


TK10


TKS16(400)


TD10


RTI2


RTI2V


RTS01

Thermostats

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.

RTI, 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.

RTS01, external sensor (accessory)
External sensor of NTC-type 10 Kohm. 3 m cable included.

An overview of all thermostats' technical specifications and functions on following pages.


KRT1900/1901


KRT2800


KRTV19


TBK10


TBKS10

Thermostats

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.

An overview of all thermostats' technical specifications and functions on following pages.

KUR

CBT

Other controls

KUR, digital time switch
Digital weekly timer with 8 different program steps (36 memory places) equipped with a changeover contact. Max. breaking current: 10 A. IP44.

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 (supply) [V]	Max input [A]	Protection class	Dimensions HxWxD [mm]
KUR	230V~	10	IP44	175x85x105
CBT	230V~	16	IP44	155x87x43

Technical specifications | Thermostats

Type	Voltage (supply) [V]	Max input [A]	Setting range [°C]	Limit floor heating [°C]	Save reduction [K]	Proportional control*1 [K/min]	Static differential [K]	Protection class	Dimensions HxWxD [mm]
T10	230V~	10	5–30	10–40	-4	2K/10min	0,5	IP30	80x80x31
TK10	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

*1) P-band [K]/time of cycle [min]
*2) Only resistive loads, no contactors.
Products beginning with T can be read as follows: K=knob, S=switch, D= digital display, B=bimetal.

Functions | Thermostats

	Basic offer				Electronic 2-step		Capillary tube			Bimetal	
	T10	TK10	TKS16(400)	TD10	RTI2	RTI2V	KRT1900/1901	KRTV19	KRT2800	TBK10	TBKS10
Internal sensor	X	X	X	X	X	X	X	X	X	X	X
External sensor	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							
Contact, 1-pole alternating			X		X		X	X	X	X	X
Digital display				X							
Advanced extra functions*3				X							
Internal setting	X				X		X		X		
Processor controlled	X	X	X	X	X	X					
Bimetal acc.resistor										X	X
Capillary tube							X	X	X		
Fits wall box system	X	X	X	X						X	X
Heating or cooling function			X	X	X	X	X	X	X	X	X
2-step					X	X			X		
Adjustable temp.diff. between the steps					X	X			X		

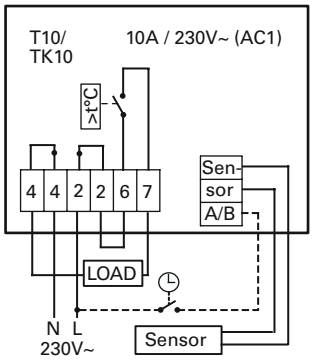
*1) External sensor (RTS01) as accessory.
*2) Can be used with an external timer.
*3) See manuals on www.frico.se.

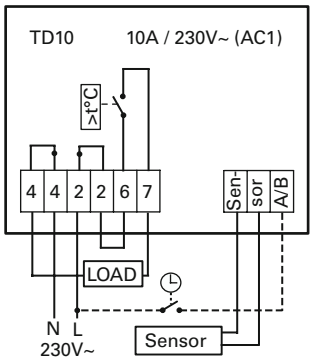
Wiring diagrams

T, TK, TD, basic offer thermostats

T10

TK10

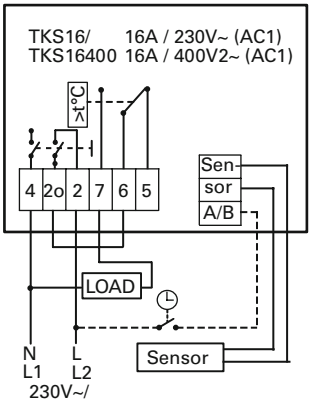




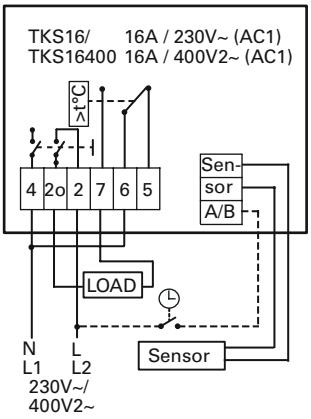
TD10

TKS16

TKS16400



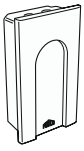
2-polig brytning /
2-pole switching



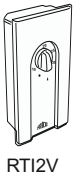
TKS16400

TKS16

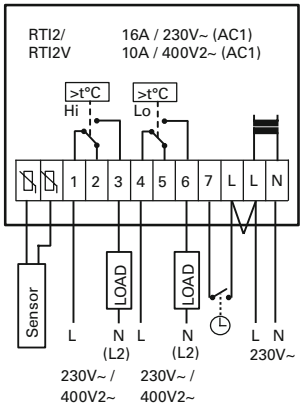
RTI, electronic 2-step thermostats



RTI2



RTI2V

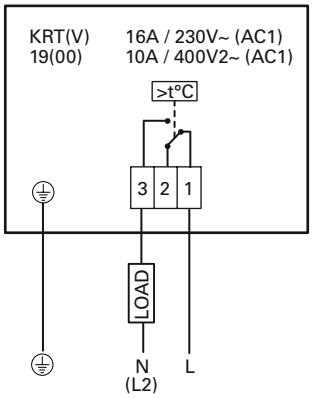


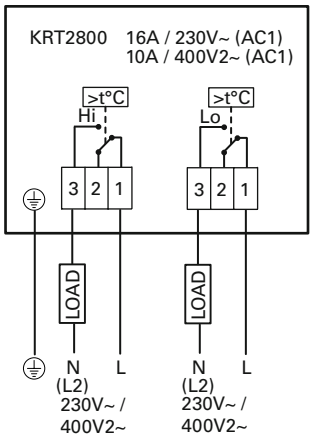
Wiring diagrams

KRT, capillary tube thermostats

KRT1900

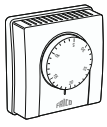
KRTV19



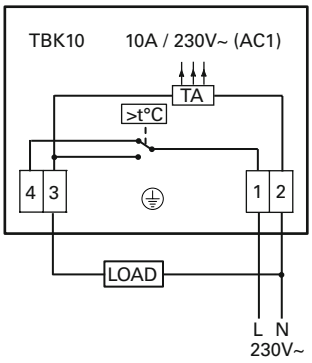


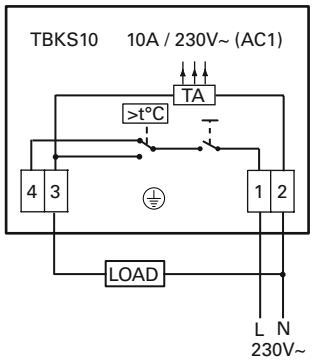
KRT2800

TBK, bimetal thermostats

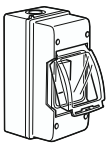


TBK10

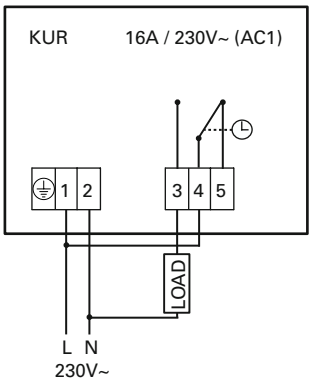


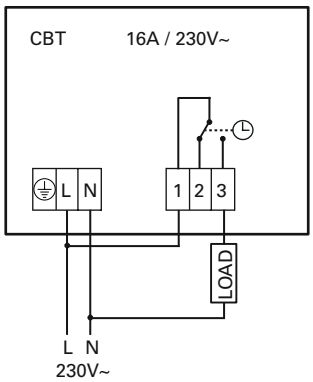


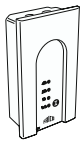
TBKS10



KUR







CBT

Contents

Heating - Energy

The need to heat a building arises from heat losses that are caused by the temperature differences between indoor air and outdoor air.

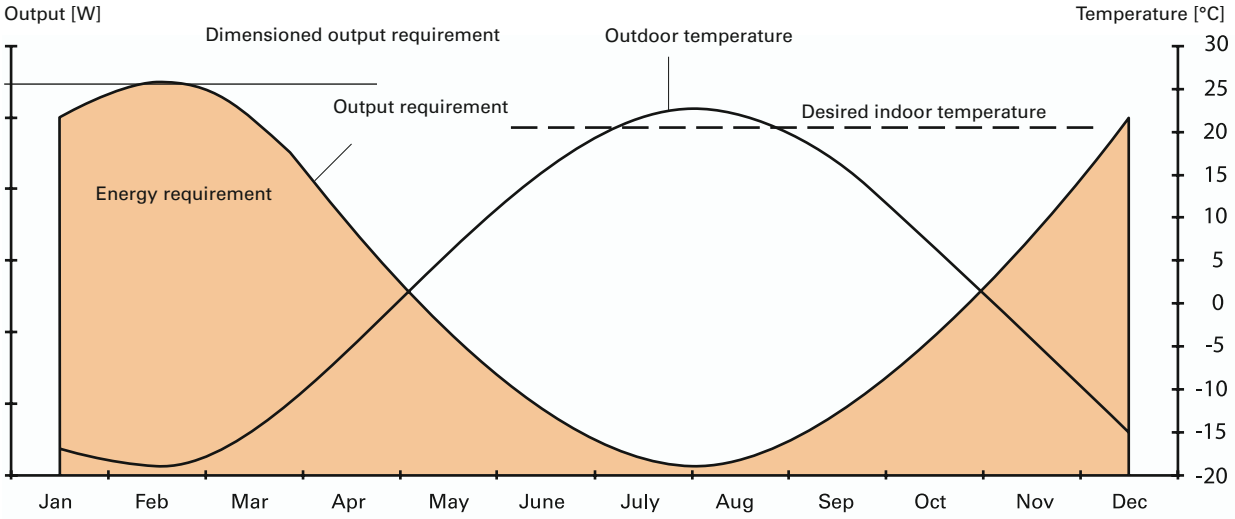
Heat losses can be divided into two parts:

- Transmission losses: Losses via parts of the building (roof, walls, etc.)
- Ventilation losses: Losses through ventilation, unsealed areas and openings.

The outdoor air temperature varies with the season and place but indoor air temperature should remain even and comfortable.

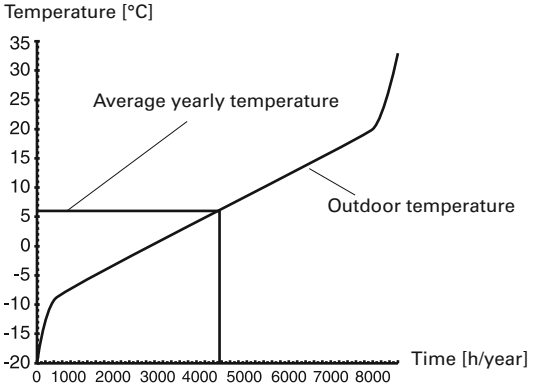
The dimensioned output requirement for a building is the output necessary to maintain the desired indoor temperature when the outdoor air temperature is at its coldest.

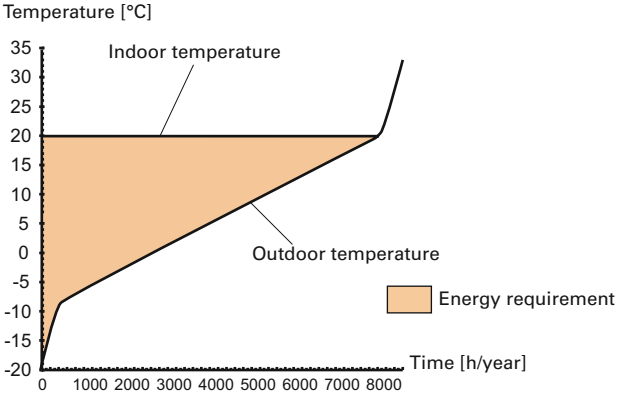
The energy requirement is the total energy requirement of the year for each hour, i.e. the area below the output requirement curve in the diagram.



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 heat losses, both from transmission and ventilation. Three main types of heating systems can be outlined:

- Radiant heating
- Air heating
- Convective heating

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.

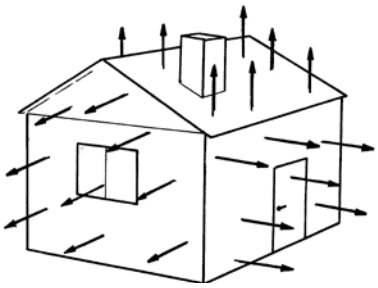
Convective heating

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.

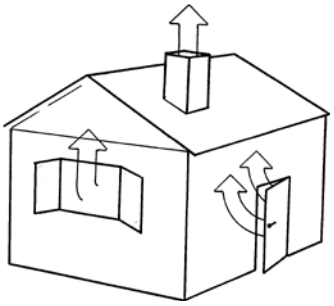
Cold draughts from e.g. windows are effectively counteracted by the rising stream of warm air if the heat source is placed under the window.

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.



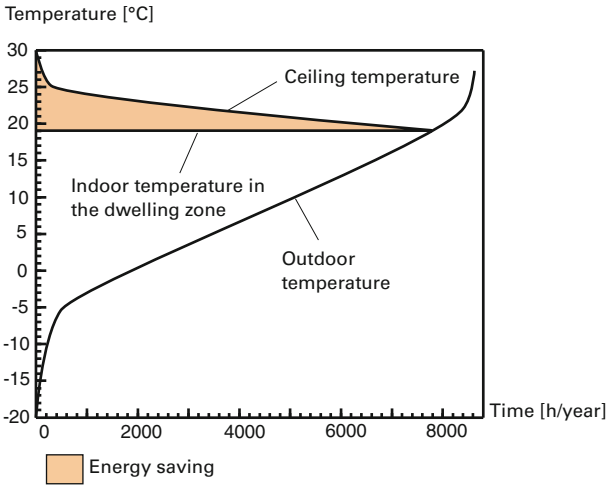
Ventilation losses
The ventilation in a building is either mechanical or of the natural type. Mechanical ventilation most often consists of a supply and exhaust air unit that makes heat reclamation possible. Natural and involuntary ventilation consists of thermal currents causing warm air to rise and leak through openings and unsealed areas.

Methods to reduce heat losses

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.

• **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.

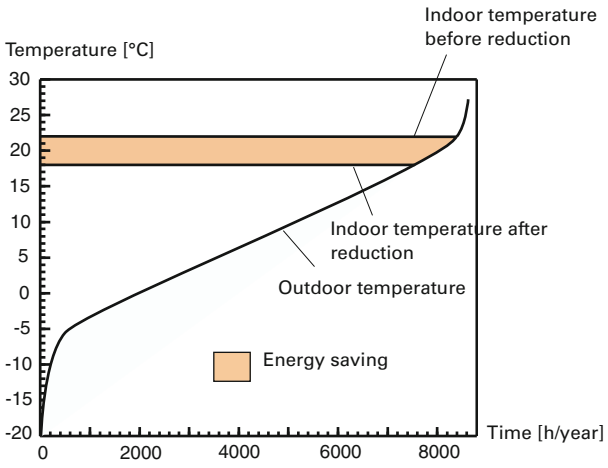


Lower indoor temperature

Another method of saving energy is to lower the indoor temperature. However, this must be done without sacrificing the comfort.

• **Time control**

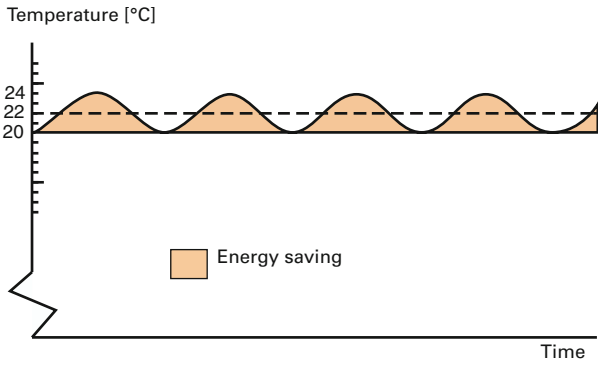
When there is no-one in the building, e.g. at night and on holidays, the temperature can be lowered.



A temperature reduction of 1 °C gives 5 % energy saving.

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 %.

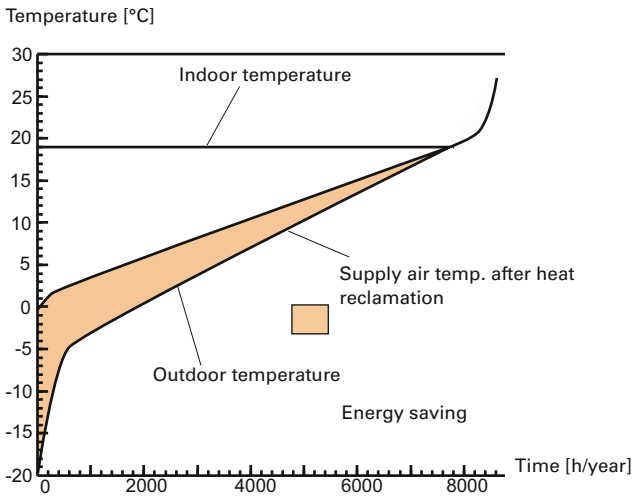


Reduce leakage

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 block between different temperature zones. Balanced ventilation and shorter opening times also contribute to the reduction of energy leakage. Read more about Frico air curtains in Product catalogue Thermozone air curtains.

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.



Fan heaters

Fan heaters economically, practically, and quickly heat such buildings as warehouses, industrial halls, workshops, community halls, farms, construction sites, etc. Fan heaters are also efficient for drying and ventilation. They are simple to install and are used both for total and supplementary heating.

Forcing air past a number of heating elements with a fan gives a very compact design that can produce very high heat output.

There are two types of fan heaters:

- Wall mounted fan heaters, for fixed installation
- Portable fan heaters, for occasional heating and personal comfort

Wall mounted fan heaters
Fan heaters are often the least expensive alternative for permanent heating of a building. They give very high output for each invested amount of money (W/money) and are easy to install. Automation is built into the units, but they can be equipped with accessories such as an automatic temperature control (for temperature reduction at night and on holidays), external thermostats, air directors, etc.

• Master and slave units
The Frico Panther-series makes installation even simpler and more economical by allowing one of the fan heaters to control several slave fans.

• Combined ventilation
Wall mounted fan heaters can be equipped with a mixing cabinet to take in fresh air and mix it with indoor air in the desired proportions. This method solves both the heating and the ventilation issue simultaneously in a simple way. The mix of internal and external air can be automatically controlled with a damper and automatic temperature regulator. This regulator can also control the exhaust fans to provide balanced ventilation.

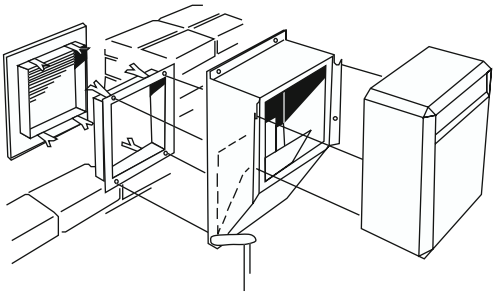
• Drying
Fan Heaters are well suited as laundry dryers in e.g. residential drying rooms.

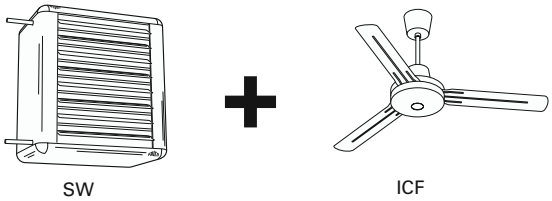
Room volume [m³]	Output [kW]	Drying capacity [kg/h]
up to 25	6	5-6
25-40	9	8-10
40-60	12	12-14

There is a special drying room kit available to the Panther series, PTRP, consisting of exhaust air fan, thermostat and timer.

• Fan heaters + ceiling fans
Heating with fan heaters should be combined with ceiling fans in rooms with high ceilings, to push down the overheated air that is gathered below the ceiling.

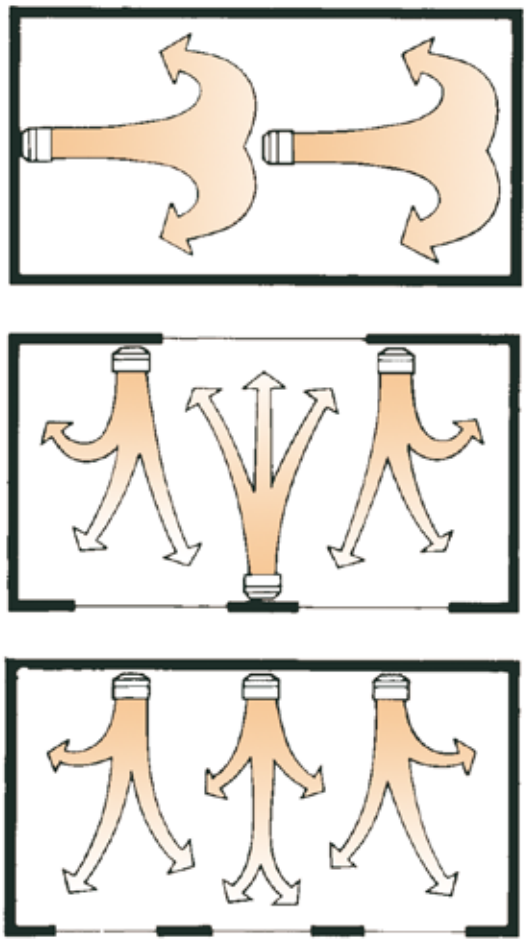
This reduces heat loss through the walls and roof while optimally utilizing the supplied heating energy. Thus, large energy savings are achieved while heating comfort is increased.





Positioning of fan heaters
Wall mounted fan heaters are often positioned high above the floor in order not to be in the way of vehicles etc. The fan heater should be aligned slightly downwards alternatively be equipped with air directors in order for the air flow to reach the floor. They should be aligned so that the air flows cooperate to form a good heat distribution in the room. The right positioning can compensate for cold windows and door sections.

Portable fan heaters
Compact, portable fan heaters are practical for personal heating comfort at construction sites and occasional heating of other rooms. Their robust design and construction make them very durable. Most fans can be temporarily hung on the wall.



These pictures show different ways to position fan heaters.

Ceiling fans

Ceiling fans push down overheated air from the ceiling to the dwelling zone. Energy losses become lower and the heat is optimally used. Savings are greatest in rooms with high ceilings where the temperature differences between the floor and the ceiling are their highest. The installation of ceiling fans to save energy requires a low investment and results in a very short pay-back time.

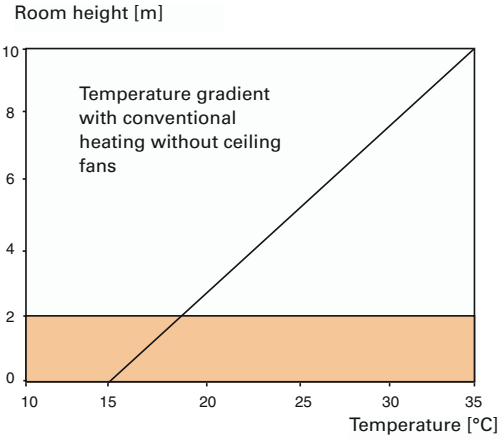
Temperature gradient

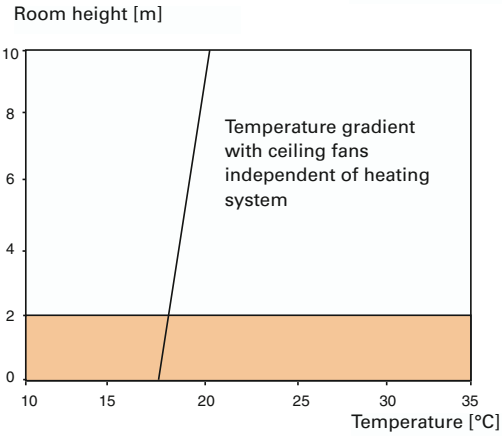
Because air density becomes lower as the temperature gets higher, warmer air is gathered in the highest spot in a room. Vertical temperature differences between floor and ceiling arise.

The temperature gradient [°C/m] is a measurement of the temperature rise per metre of height inside a room. It varies with different forms of heating and with the season (output usage).

Temperature gradients for different forms of heating at full output usage:

Convectors:	2–2.5 °C/m
Fan heaters:	2–2,5 °C/m
Radiators:	1,2–1,7 °C/m
Radiant heaters:	0,2–0,4 °C/m
Floor heating:	~0,1 °C/m



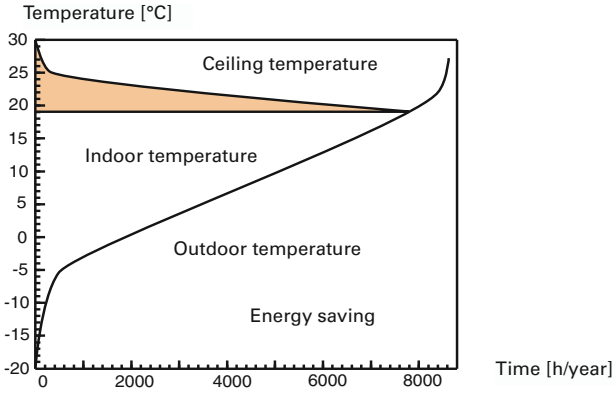


Ceiling fans equalize the temperature difference

Ceiling fans push down overheated air from the ceiling to the dwelling zone. The temperature gradient sinks. The heat is better used and heat losses through the roof and walls are reduced.

Energy savings

In rooms with high ceilings, heat losses can be reduced by up to 30% through the simple use of ceiling fans to push down the heat to floor level. Heating costs are decreased and the working environment improved. For heating systems with high temperature gradients, the savings are enormous.



Low energy consumption

A ceiling fan uses no more output than a 75 W light bulb and is simple and inexpensive to install. The pay back time is very short.

Air mixing

Air mixing provides even faster heating of cold goods, better drying capability, and reduced risk for cold draughts.

Light fixtures last longer

The high heat at the ceiling is hard on light fixtures. A reduction of the temperature by 5–10°C lowers your maintenance costs and raises the durability of light fixtures.

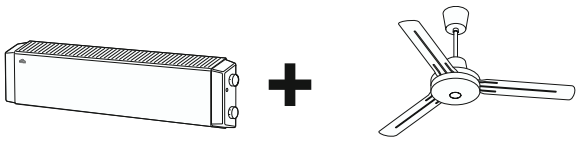
Convectors

The rotary movement of air maintained by thermal currents in a room where the air is affected by a heat source, either convectors or radiators, is called convection. The air gets warm and rises then cools off and returns to be heated again. Sometimes small built-in fans can "help" to increase convection.

Heating - drying

The heat from radiators comes mainly from convection. Heat radiation from the radiator's surface always makes up part of the heat, which gives a somewhat lower temperature gradient, about 1.7°C/m compared with that of fan heaters, approximately 2.5°C/m. In radiator-heated rooms with high ceilings, it is thus still profitable to try and push down overheated air with e.g. ceiling fans.

Convective heat is often suitable to use primarily to cover transmission losses in rooms with natural ventilation. If the building has mechanical ventilation, the ventilation unit itself should include a heater to warm up the supply air. The rotary air stream contributes to an equal distribution of temperature in the room and is also an effective dryer for damp spaces.



Thermowarm ICF

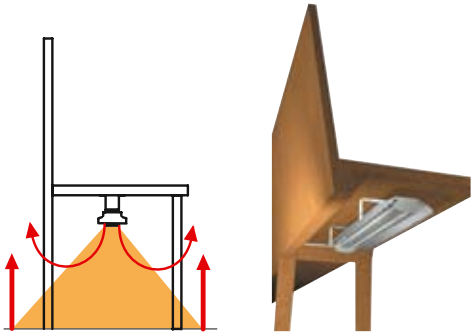
Counteract cold draught

The upward directed warm air stream is used to counteract cold draughts from e.g. windows. A common positioning of convectors is on the wall beneath windows. This relatively low positioning requires that the radiators are robust and wellprotected against damage, especially in public rooms. The surface temperature must not be so high that it can cause burn injuries.

Bench heaters

Heating with bench heaters, e.g. in churches, gives a very economical and gentle heat. The bench heaters are mounted under the seat of the bench and disperse heat both through convection and heat radiation.

The floor and the air around the benches are heated and create very good heating comfort in the dwelling zone. The large air volume, especially in high-ceilinged churches, is not heated with the same method. Large energy savings are obtained at the same time that sensitive fittings are protected from temperature variations and dehydration.



Controls

The control system is the "heart" and the "brain" of a heating system and often decisive for both comfort level and energy consumption. The temperature of an electric heating system can be quickly, easily, and exactly regulated more than in any other heating system.

Heat control

The heat balance in a building is a dynamic interplay of several factors that can be divided into three main groups:

- Heat losses
- Heat contribution
- Heat storage

The purpose of heating (the heat contribution) is to cover the differences between the various posts so that the desired temperature can be maintained in the building. In practice, both the climatic stresses (outside temperature, sunshine, wind) and the heat contribution to a building vary over time. The variations can be long-term, such as with the seasons, or shorter, such as when the sun is hidden by clouds, a room is filled with people, or when a door is opened. The ability of the sections of the building to store heat is of great significance for the shorter variations.

One of the greatest advantages of an electric heating system is that temperature can be regulated simply, quickly, and more exact than in any other heating system. It is however vital to choose the right control and regulation system, as it determines the comfort level and energy consumption of the building.

On/Off control, termostatic control

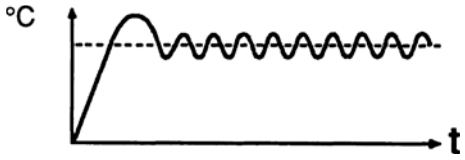
For electrical heat it is enough with an accurate on/off regulation through thermostat. A 2-stage thermostat improves the accuracy and makes it possible to run on higher or lower output, depending on the heat demand. The electrical heat output can also be controlled by an output selector. Hot water heat is controlled by a single stage thermostat.

Thermostats can be divided into two types :

- Mechanical thermostats, with e.g. bimetal or capillary tubes as external sensors
- Electronic thermostats, with resistance sensors as external sensors

Both types of thermostats control the output on/off around the desired temperature, which means that the temperature fluctuations around the set value can be wide. By using electronic thermostats, the precision of regulation can be adjusted to achieve somewhat lesser fluctuations. See the temperature curve for on/off control.

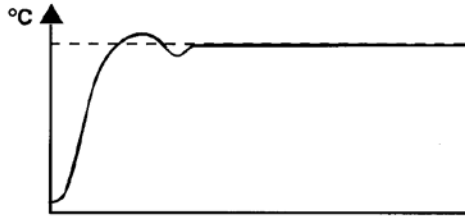
The choice of thermostat depend on among other things in which environment it should be used. In a shop setting an electronic thermostat is often selected. It is visually more appealing, but has a lower protection class. In an industrial setting with higher demand on protection class, a capillary tube thermostat is often selected.



Electronic output regulation
Electronic, proportional output regulation results in the optimal contribution of heating energy to the building based on the current temperature. Output is turned on and off in pulses of varying length depending on how far the temperature is from the set value.

The temperature reaches the desired level faster and fluctuations around the set value are avoided.

Example: After a night time reduction period, the regulator call for full output until the temperature is approx. 1.5 - 2 °C below the set value. Afterward, the heat is turned on and off in determined time cycles according to the approach of the set value. At 1 °C below the set value, the in/out connection time is approx. 30 seconds and at 0.5 °C below the set value, the time is 15 seconds.



Programmable heating regulation
Modern electronics allow very advanced, completely customised heating regulation. Microcomputers consider several affective factors simultaneously and adapt (regulate) the heating sources for the best comfort and energy effectiveness.

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

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

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.

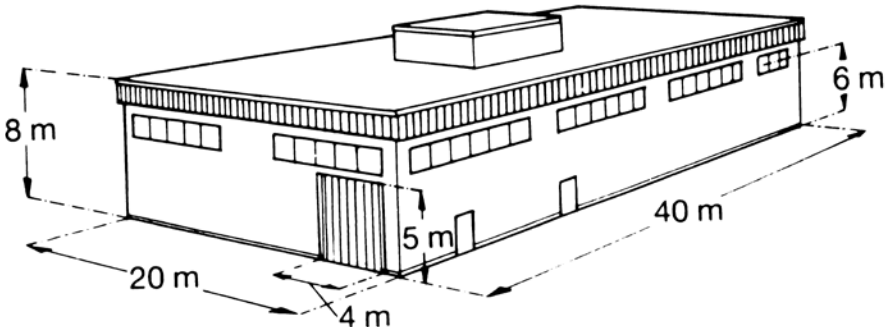
You can also fill out the calculation form on the next page. Copy it and mail it or fax it to us for calculations and suggestions for savings. Even if all values are not available, we can still do usable calculations. If, for example, the U-values are missing, supply materials, thickness, and insulation information can be given instead. Please attach any explanatory drawings or sketches.

Calculation form

On our website www.frico.se, you have the possibility to easily make your own output calculation. You are also welocme to copy this page, fill out all known details, send by mail or fax to Frico Technical support. We assist you with calculation and dimensioning. This page is also available on our website.

Company:	**Contact person:**
Address:	**Telephone:**
	Fax:
	e-mail:
Project:	
Building:	Length:
Location:	Width:
Construction year:	Height:
Flat or irregular ceiling:	
Number of windows:	Window heights:
Mounting height of window:	Window widths:
Number of doors:	Door heights:
	Door widths:
Wall surface of heated space:	
Window type or U-value:	1-,2-,3 pane:
Door type or U-value:	
Number of openings per day:	Duration of each open time:
Outer wall type or U-value:	
Ceiling type or U-value:	
Floor type or U-value:	
Desired temperature (day):	Desired temperature (night):
Internal heat (from lighting, machinery etc):	Activities in the building:
Infiltration (Ventilation air flow and leakage) day time (cha/h):	Infiltration (Ventilation air flow and leakage) night time (cha/h):
Efficiency of reclamation:	Natural ventilation:
Operation time/day, day temperature:	Operation time/day, night temperature:
Present heating system:	
Present energ price and energy form:	

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 × 97330 × 12/24 × 5/7 = 29 MWh/yr
Night: 20909/33 × 97330 × (1 - 12/24 × 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	
Energy price, electricity	0.50 SEK/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	72 906	103 067	81 623	SEK/yr

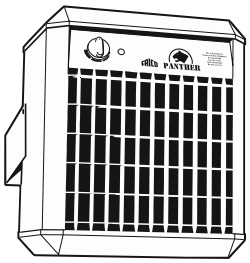
Heating with fan heaters

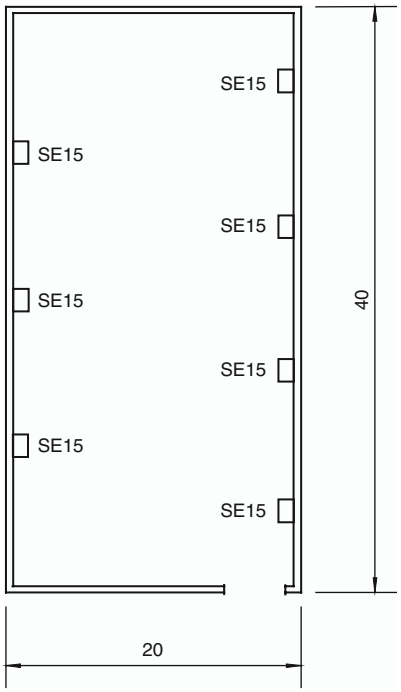
Assume that the industrial building in the example is to be heated with fan heaters. Based on that, we make a computer calculation of the energy and output requirements especially for this method of heating. The calculation program also takes the temperature gradient °C/m (temperature rise per metre of height) into consideration which is of great importance with reference to the height of the building and the method of heating. Fan heaters have a temperature gradient of 2.5°C/m.

Recommendations and positioning

The output requirement for the industrial building is just over 100 kW.

Recommendation:
Seven fan heaters at 15 kW = 105 kW
We choose Frico Panther-series:
Seven SE15 fan heater
Two PP15 control panel





Energy savings with ceiling fans

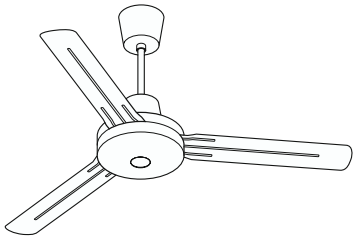
Assume that the industrial building in the example is heated with fan heaters. Now, we outfit the building with ceiling fans and do a new computer calculation of the energy and output requirements.

Energy saving

A comparison of the energy requirement results from the calculations:

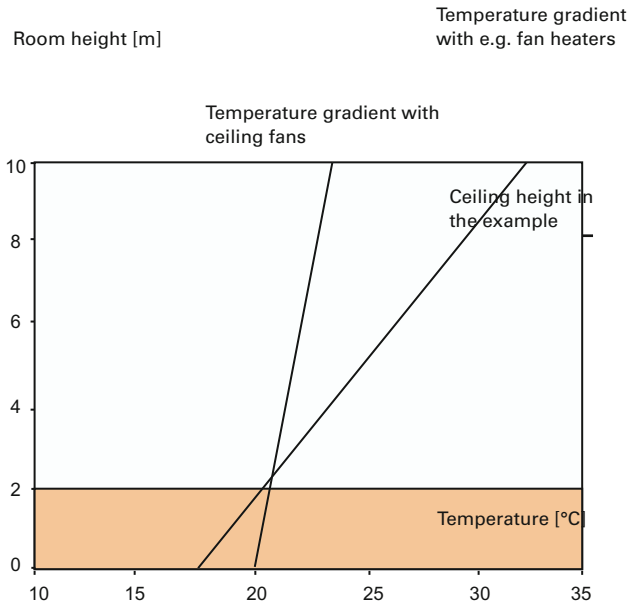
Fan heaters (p. 161) :	206 MWh/yr
Fan heaters and ceiling fans:	163 MWh/yr
Energy saving:	43 MWh/yr

Ceiling fans result in approx. **20 % lower energy consumption** in the industrial building.



Savings factors: Lower temperature gradient

Ceiling fans equalize the temperature differences between ceiling and floor. At full output, heating with fan heaters gives a relatively high temperature gradient of 2.5%°C/m. Ceiling fans push the overheated air down from the ceiling to the dwelling zone, thereby lowering the temperature gradient to 0 - 0.3°C/m. Heat losses are lowered and the supplied heating output is better utilized.

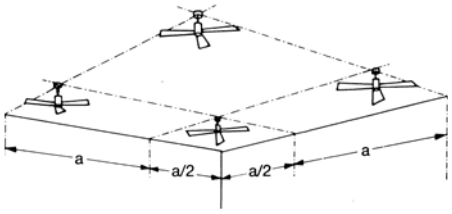


Temperature gradient at full output

Dimensioning

For optimal effectiveness of the ceiling fans, we use the diagram below for their most appropriate spacing.

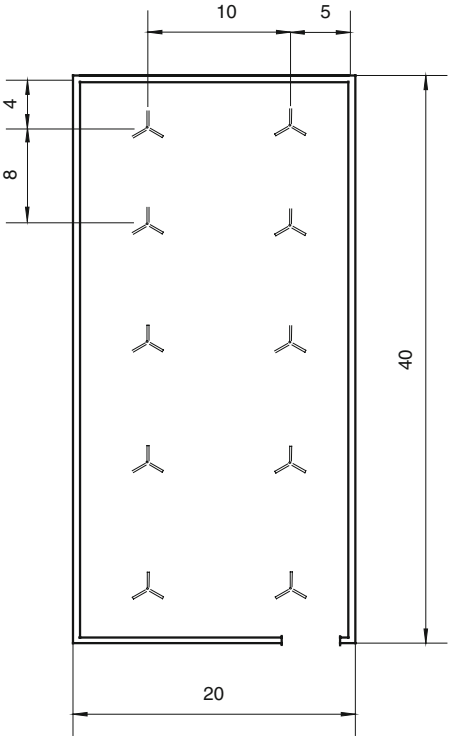
Recommended distance between the fans					
Ceiling height [m]	4	6	8	10	12
Fan distance a [m]	5	7	8	9	10

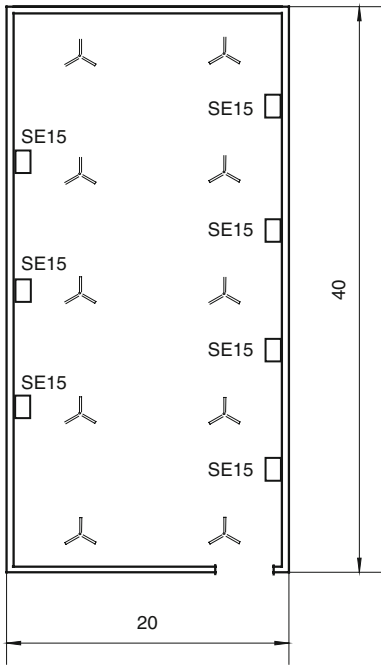


Recommendations and positioning

Recommendation: 10 ceiling fans ICF
One automatic fan speed regulator, type CAR15.

The optimal distance between fans is 8 metres, but an adjustment to the dimensions of the room increases the distance slightly. The automatic fan speed regulator senses the temperature difference between ceiling and dwelling zone and optimize the fan speed for max. equalization of the temperature.

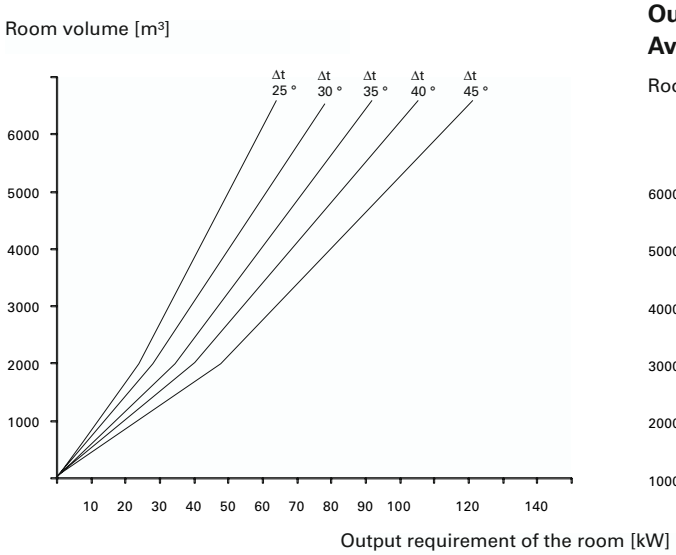




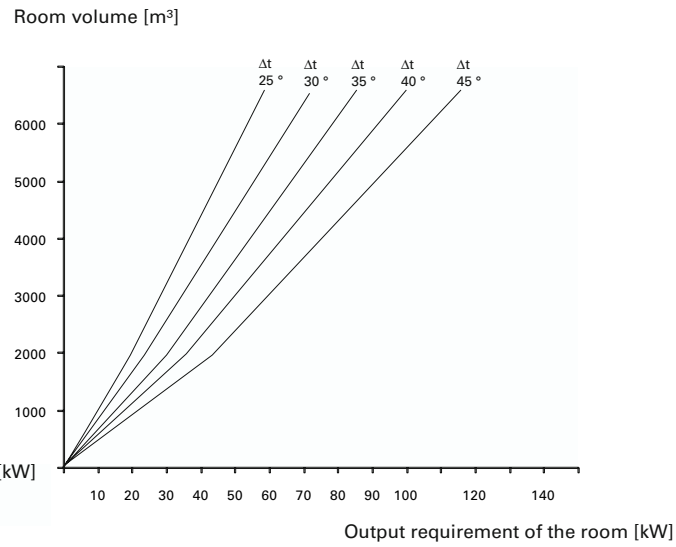
Ready reckoner, output requirement

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 ~~properly 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.

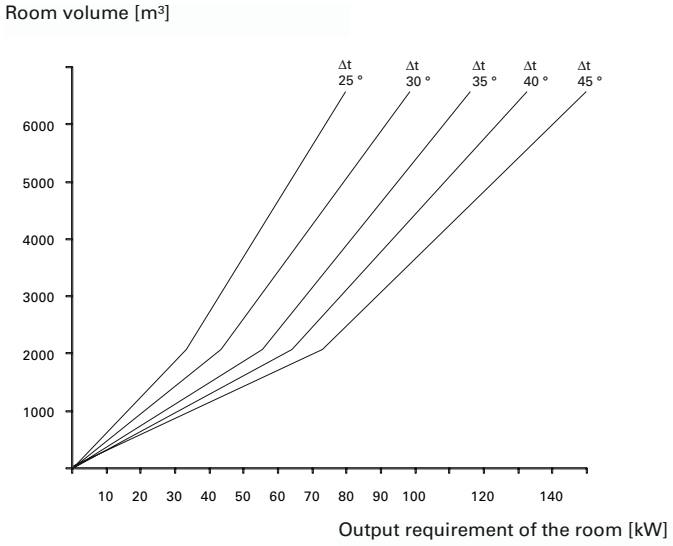
Output requirement diagram A
Average U-value 0.25



Output requirement diagram B
Average U-value 0.4



Output requirement diagram C
Average U-value 1,0



Tables and diagrams 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=If$\sqrt{3}$

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=$U_f\sqrt{3}$	U=U_f

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=$\sqrt{3}$ UI cosφ	P=$\sqrt{3}$ 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.
$\sqrt{3} \cong 1.73$
I = amperage in ampere
If = amperage in ampere in phase wire
R = resistance in ohm
P = output in watt

Symbols for model types

= normal design (no symbol)
= drip-proof design
= splash-proof design
= jet-proof design
= water-tight model

Protection classes for electrical material

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 wires

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
Amperage at different outputs and voltages

Output	Connection wires					
[kW]	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:

$1/U = R_{si} + R + d_1/\lambda_1 + d_2/\lambda_2 + \ldots\ldots + d_n/\lambda_n + R_{se}$

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

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
Woos, 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	U-value [W/m2°C]
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:

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

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

Sound

Sound is an important environmental factor, equally important as good light, fresh air and ergonomics. What we usually call the sound level of a product is actually the sound pressure level. The sound pressure level includes the distance to the sound source, the position of the sound source and acoustics of the room. This means that a silent product is essential, but the whole environment needs to be considered to achieve a comfortable sound level.

What is sound?

Sound is caused by air pressure fluctuations that evolve when a sound source vibrates. The sound waves that are produced are condensation and dillusion of air particles without the air in itself moving. A sound wave can have different velocities in different media. In air the sound has a velocity of 340 m/s.

How is sound measured?

Sound level is measured in decibel (dB). The dB is a logarithmic unit used to describe a ratio. If the sound level is increased by 10 dB, the result is twice as loud (matematically it is 6 dB, but the way we hear it, it is 10 dB).

It is also useful to know that two equally strong sound sources give an added sound level of 3 dB. Assume you have two entrances with two air curtains in each entrance, all four units with a sound level of 50 dB. The total sound level will then be 56 dB. The first opening will have a total sound level of 53 dB plus an extra 3 dB from the other opening.

Points of reference – dB

0	The softest sound a person can hear
10	Normal breathing
30	Recommended max. level for bedrooms
40	Quiet office, library
50	Large office
60	Normal conversation
80	Ringing telephone
85	Noisy restaurant
110	Shouting in ear
120	The threshold of pain

Fundamental concepts

• Sound pressure

Pressure develops when pressure waves move, for example in the air. The sound pressure is measured in Pascals (Pa). To clarify sound pressure a logarithmic scale is used which is based on the differences between the actual sound pressure level and the sound pressure at the threshold of hearing. The scale has the units decibels (dB), where the threshold of hearing is 0 dB and the threshold of pain is 120 dB.

The sound pressure decreases with the distance from the source and is also affected by the acoustics of the room.

• Sound power

Sound power is the energy per time unit (Watt), which the object emits. Sound power is calculated from the sound pressure and also uses a logarithmic scale. Sound power is not dependent on the sound source nor the acoustics of the room, which therefore simplifies the comparisons of different objects.

• Frequency

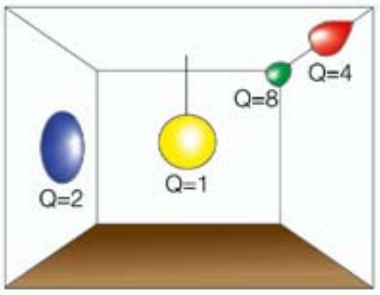
A sound source's periodical oscillation is its frequency. Frequency is measured as the number of oscillations per second, where one oscillation per second is 1 Hertz (Hz).

Sound power level and sound pressure level

If the sound source emits a certain sound power level, the following will affect the sound pressure level:

1. Direction factor, Q
   Specifies how the sound is distributed around the sound source. See figure below.
2. Distance from sound source
   The distance from the sound source in metres.
3. The rooms equivalent absorption area
   The ability for a surface to absorb sound can be expressed as an absorption factor, α, which has a value between 0 and 1. The value 1 corresponding to a fully absorbing surface and the value 0 to a fully reflective surface. The equivalent absorption area of a room is expressed in m2. This can be calculated by multiplying the room's surface area by the surfaces' absorption factor.

With these known factors it is possible to calculate the sound pressure if the sound power level is known.



The distribution of sound around the sound source.

Q = 1	Middle of room
Q = 2	On wall or roof
Q = 4	Between wall and roof
Q = 8	In corner

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