



Lindab **Radiant heating**

In high and large spaces



We simplify construction

At Lindab we are driven by a strong desire to continuously generate improvements and to simplify construction. We do that by developing products and systems that are easy to use and energy efficient, together with industry-leading knowledge, support, logistics and efficient availability.

We want to simplify everything – from designing, ordering, delivery, goal achievement and installation to the entire way of doing business with us. By simplifying in every stage of the construction process, we also contribute to energy-efficiency.

A good thinking company

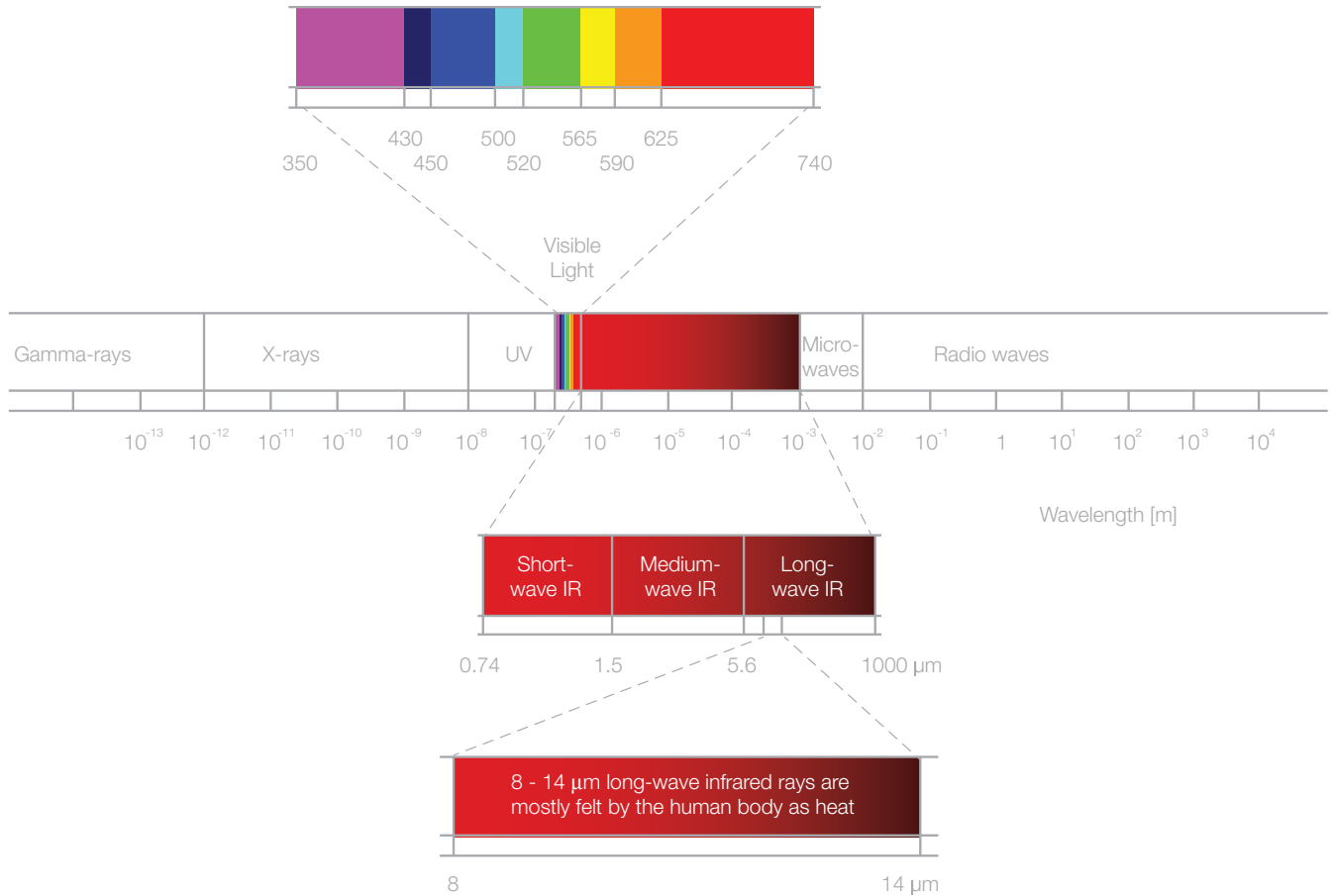
Good thinking is a deeply rooted philosophy that guides us in everything we do. We firmly believe that good thinking makes good solutions to the challenges we all face. Taking responsibility for what we do and how we do things is therefore important to us. Because good thinking is not only about making life easier and more comfortable for our customers and end users. It is also a matter of thinking in a global perspective, all the time. Knowing that we at Lindab are helping to make the world a better place.

Lindab Radiant Panels – Heating with minimised waste

In large volume spaces it is often uneconomic and impractical to heat the entire air volume in order to provide a comfortable indoor climate to people working or visiting within that space.

Lindab radiant panels provide the perfect solution to this problem. By using radiant heating to heat objects and people directly without the wasteful need to heat the surrounding air, radiant panels provide an ideal low cost flexible solution to heating in large areas.





Radiant heating – what is it?

No need to be worried – radiant heating has nothing to do with UV rays (which give a sunburn or damages our skin). Radiant heating is one of energy transmission forms, and occurs when energy is transmitted from a hotter body to a colder one directly, without heating the surrounding air.

Radiant heating is also referred to as infrared radiation (hereinafter “IR”). In Latin, “infra” means “below”. In simpler terms, radiant heat, or IR, is just light, only we cannot see it. IR is just below visible red light in the electromagnetic spectrum (the segment wavelength falls within the spectrum range from 0.74 to 1,000 μm). IR can only be seen using special cameras (imagers), which represent IR rays as colours visible to the naked eye.

IR wavelengths can be short, medium, or long. Of interest to us, are long-wave IR rays, short-wave IR rays are closer to the red colour of the visible light spectrum, while long-wave ones are closer to the microwave segment in the electromagnetic spectrum. Short-wave IR rays are not hot at all, and we

cannot even feel them. We use short wave IR in our lives every day each time we use a remote control. Long-wave IR rays are thermal rays. Though we do not see IR rays with the naked eye as we see, for example, light, we feel the “light” of this type as heat!

The sun is the main source of radiant heat that we experience and feel every day. It is only because of the radiant heat radiated by the sun that life in our planet exists. It is the IR segment of the spectrum where the sun generates most of the energy radiated. However, the sun is not the only source of radiant heat.

Any object with a temperature higher than absolute zero (-273.15°C) radiates IR energy, the amount of which depends on the current temperature of the object. IR rays are radiated due to the excitement (vibration) of molecules within the hot body, and the intensity of this vibration depends on the temperature of the object. The higher the object temperature, the higher the intensity of molecular vibration and as a result the higher the energy of IR radiation released which, in turn, when

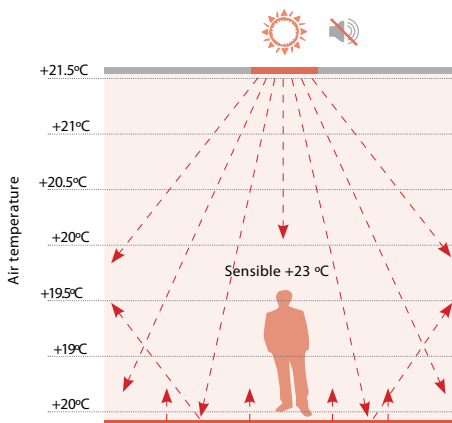
reaching another object, causes molecular movement felt as heat. Also, the higher the object temperature, the shorter the wavelengths of IR rays which are radiated by the object resulting in a higher energy release.

However, it is wrong to assume that the hotter the object, the more efficient a radiant heater is. When the temperature of the object (the heater) becomes extremely high, a large part of the energy is radiated as light – visible radiation – and the heater efficiency decreases significantly. This is why we can see the radiance (light) of objects, whose temperature is very high (more than 600° C), as colours from red to white (candle flame is a perfect example).

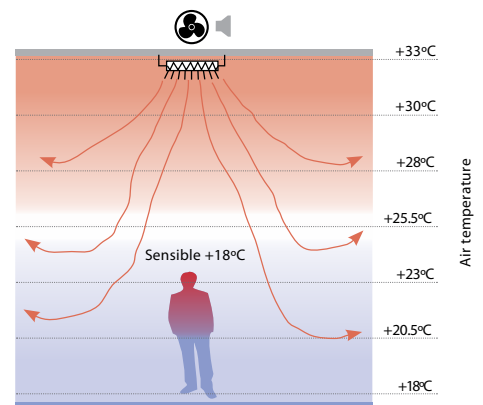
But we need a heater, not a luminaire! Also, it is important to note that the invisible part of the spectrum carries 100,000 times more energy than the visible one! Each hot object radi-

ates the maximum amount of heat only within a certain wavelength range. The most efficient radiant heating is obtained when the infrared wavelength falls within the range of 8 µm and 14 µm. It is of this very wavelength that IR rays, emitted by radiant heaters, are felt by our body as heat. Radiant heaters produce maximum IR emission when their temperature does not exceed 105°C.

So IR heating works by heating an object directly without heating all the air in between, let's think about that for a minute. How much energy would be consumed in heating all the air in say, an aircraft hangar, to ensure that the work force are kept at a comfortable ambient temperature. Now imagine if you could keep your staff warm without heating up all that air, need we say more! The potential energy saving is obvious.



Hot water transfers heat to the radiant heating panel. The panel releases heat in the form of infrared radiation. Initially the room surfaces and objects inside rather than the air heat up. We always feel a temperature higher than the surrounding air temperature. Therefore, energy losses much lower.



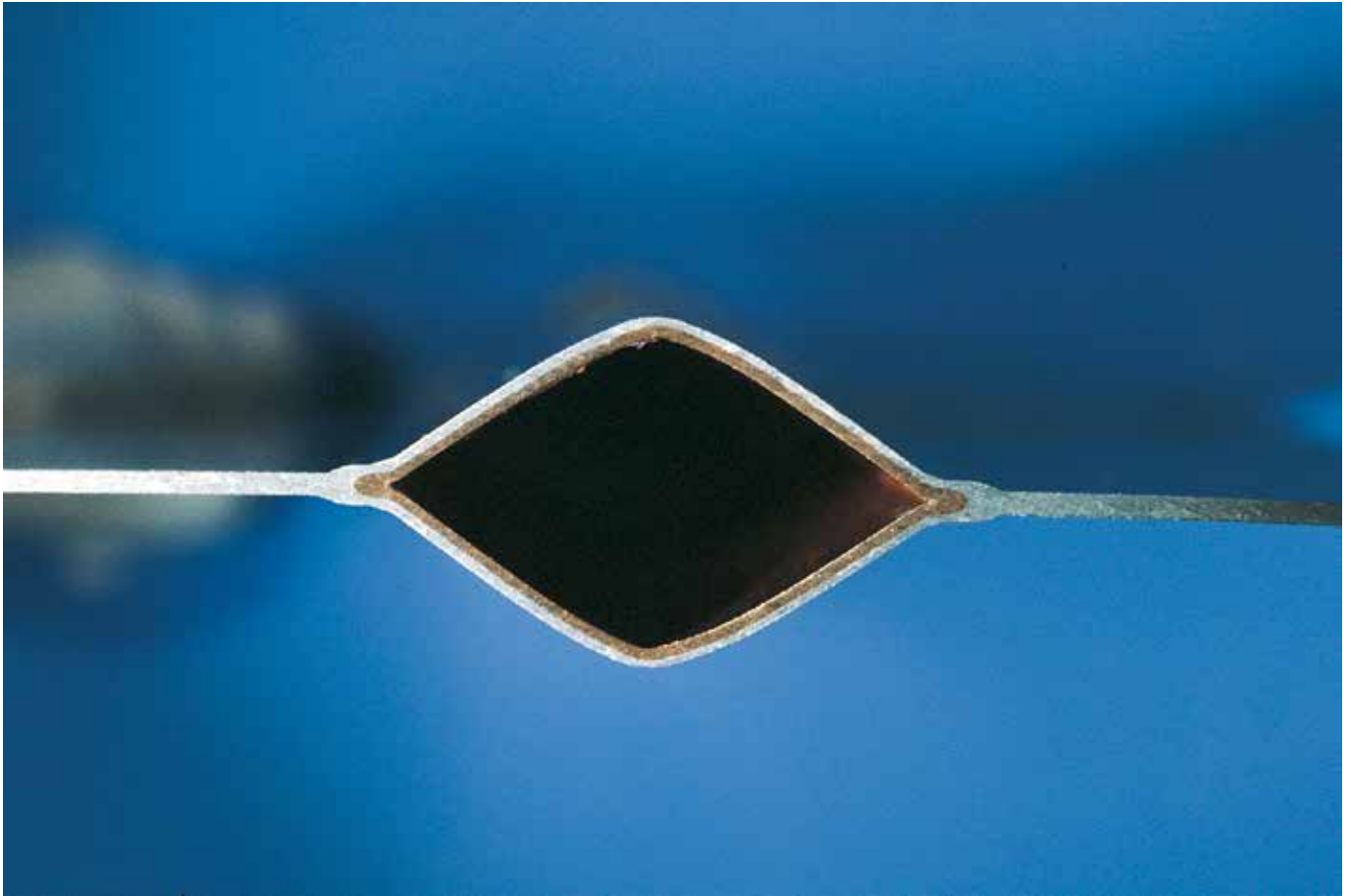
Natural radiant heating:

- Uniform heat distribution
- Lower energy costs
- No noise, no air flow
- Room cooling is an option
- Energy and money saving
- Excellent comfort in the room
- Virtually Maintenance-free

Ordinary air heating:

- Significant temperature differences
- Higher energy costs
- Additional electricity costs
- Non-uniform heating
- Noise
- De-stratification may be require
- Forced air movement in the room





Radiant heating panel

Operating principle

Hot water, flowing through a copper pipe, transfers heat to the aluminium surface of the panel with very low energy losses. The surface of the heating panel heats up and radiates heat into the room. First of all, surfaces and objects within the room heat up, including people, floors, walls, furniture, equipment, etc. When the temperature of the surfaces and objects becomes higher than the room air temperature, they too radiate heat and heat up the air in the room. Therefore, significant energy savings are achieved by heating the surfaces and objects in the room directly rather than heating all the air in the room. A high ceiling is not an obstacle to radiant heating panels. On the contrary, radiant heating is the best choice for such a room. Heat is radiated tens of metres down to the floor without energy losses. In this way, a large empty air space, where heated air would normally float high above the working area, is not heated in vain. Heat directly reaches those very places where it is required most of all.

Design

The design of Lindab heating panels is based on the globally patented principle of chemically compounding a copper tube onto an aluminium panel. The aluminium panel is connected with the copper tube by a high-pressure method (the materials are partially alloyed by ultra-high pressure). In this way, the best possible transfer of heat between the tube and the panel is established. The copper tube is of a diamond shape ensuring maximum heat transfer. The upper part of the heating panel is insulated with a moulded plastic insulation, which is produced without the use of freon, i.e. without CFC or HCFC gases.



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Shopping space

Situation:

On the trading floor of a large supermarket, cash registers are installed close to glass display windows and/or frequently opened external doors, so these working areas are always exposed to draught and are hard areas within which to maintain an ideal ambient temperature. The temperature in the cashiers' working area often drops below ideals and can become uncomfortable simply increasing the air temperature in the whole supermarket is not a rational solution.

The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- To heat a particular area, while overcoming the inflow of cold air
- To effectively heat the area without impinging on trading space
- To heat only the required working areas.

Advantages:

- Radiant panels do not hinder activities at all and do not occupy space on walls or floors because they are ceiling mounted.
- The height of the ceiling does not influence the temperature at the working place.
- The radiant heating panels can be moved if the layout of the room changes.
- The required temperature in a large space can be varied from area to area without installing any partitions.
- Simple and easy to control.
- The maintenance of the system does not require any special qualifications – lower maintenance costs.
- Energy efficient.
- Virtually maintenance-free.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Spaces with high glass ceilings and glass walls

Situation:

The glass roof structure and walls of many reception areas allow cold air to permeate, causing temperatures in the room to fall quickly, whilst draughts can constantly form against the windows. Having your reception staff bundled up in winter clothing is not a realistic solution! Heating the whole air mass of a spacious area by maintaining a uniform temperature level would be uneconomic.

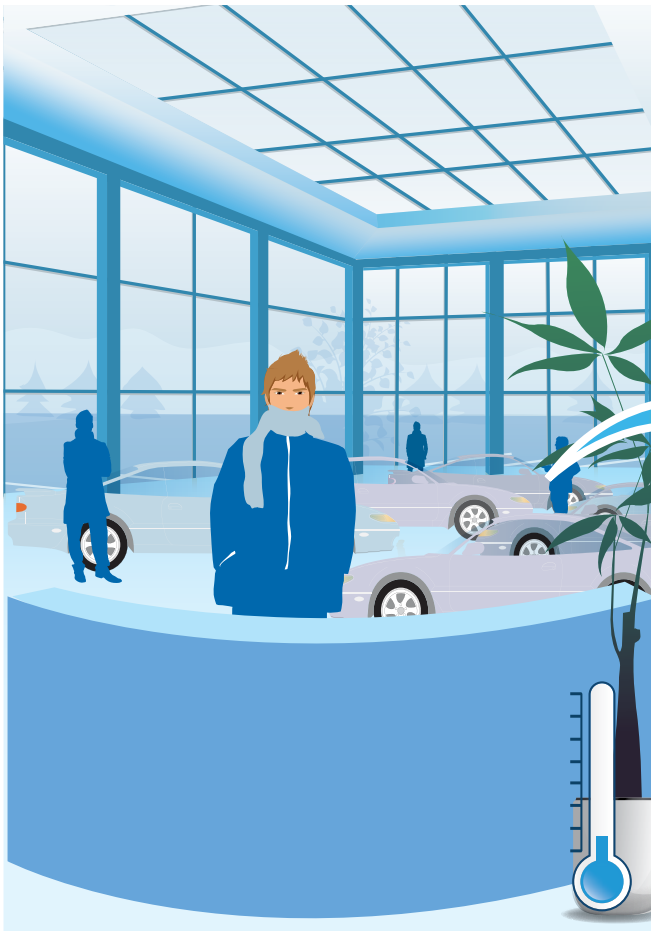
The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- To heat the required area only – by installing radiant panels above the working place of the reception staff.
- To suppress the inflow of cold by heating the required area – by mounting radiant panels under the ceiling along the glass walls.

Advantages:

- Radiant panels do not hinder activities at all and do not occupy space on walls or floor because they are mounted under the ceiling.
- Aesthetically – you can choose either suspended appliances or ones built-in into the suspended ceiling. They can be painted in the desired colour or decorated to match the décor.
- Mobile – radiant panels are adaptable even when the layout of the room is changed.
- The maintenance of the system does not require any special qualifications – lower maintenance costs.
- Energy efficient.
- Virtually maintenance-free.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Working place in a large space

Situation:

An automobile showroom designed with a modern metal and glass structure. The glass walls and ceilings are permeable to cold, and typically with large doors constantly opening and closing the whole showroom can easily become cold. Having high temperatures to compensate is impractical for the whole automobile showroom, and maintaining the required heat level in any single working area is very difficult.

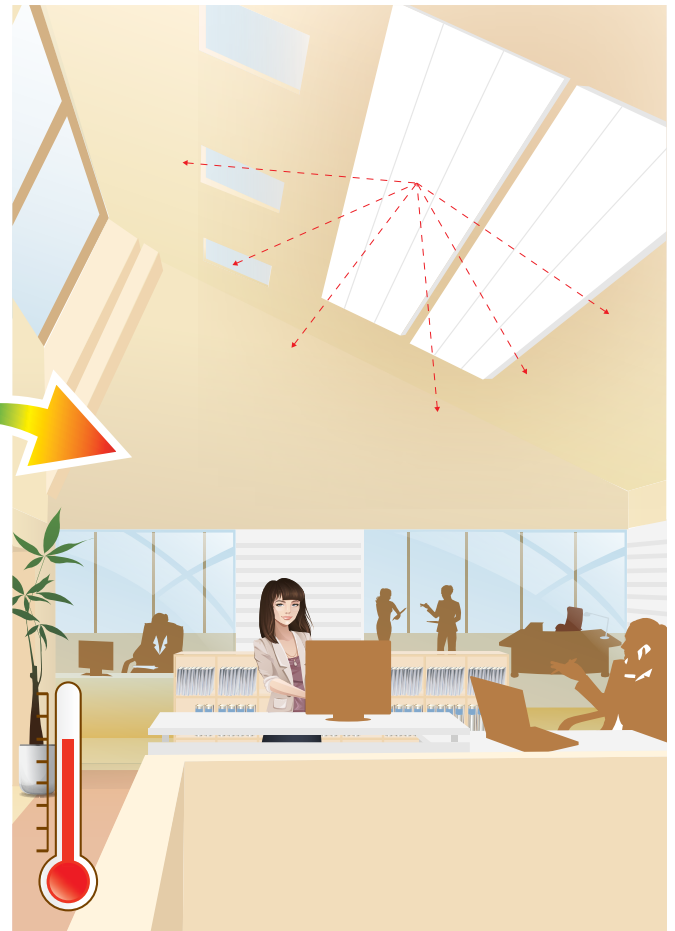
The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- To heat only the required working area, while suppressing the inflow of cold – by installing radiant panels above the permanent work places

Advantages:

- Radiant panels can be mounted by suspension on chains or by using guy wires, or can be installed into a suspended ceiling.
- The radiant heating panels can be moved if the layout of the room changes.
- Radiant panels do not hinder activities at all and do not occupy space on walls or floor because they are mounted under the ceiling.
- The height of the ceiling does not influence the temperature at the working place.
- The required temperature in a large space can be varied from area to area without installing any partitions.
- Energy efficient.
- Virtually maintenance-free.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Administrative space

Situation:

In a typical office block, the arrangement of working places constantly changes. Due to the frequent redesign of premises, heating appliances should ideally not occupy space on the floor or walls so as not to interfere with or restrict office layout.

The solution lies in radiant heating panels:

- To heat the area without impinging on office layout.
- To heat required objects, items, people, but not the air mass.
- To heat the required working area by installing radiant panels on the ceiling.

Advantages:

- Radiant panels do not hinder activities at all and do not occupy space on walls or floor because they are mounted under the ceiling.
- Radiant panels can be installed at an inclination and are therefore also suitable for sloped ceilings.
- Radiant heating systems are easily adaptable even when changing the type, purpose, layout, and structure of the premises.
- Radiant panels are universal in terms of the use of the premises – they are perfectly adaptable both to an office, dance studio, gym, storerooms, or most applications you can think of.
- The required temperature in a large space can be varied from area to area without installing any partitions.
- Energy efficient.
- Virtually maintenance-free.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Industrial space

Situation:

Factories by their nature are typically massive buildings. Usually, involving large volume areas where cold spreads quickly, however it's not only the air that becomes cold in these high and spacious areas, but also the working equipment such as tools, and workbenches which add to the cooling effect.

Since a constant high temperature is not required in the whole factory building, it is reasonable to heat only the working areas. However it is very difficult to maintain an ideal air temperature in working areas because generally a factory does not have permanent working places. If an air heating system is employed, then destratification will be required to prevent hot air floating up to the roof space but items such as moving cranes mounted at high level leave very limited space to achieve this.

The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- Radiant panels can be installed in targeted areas.
- Radiant panels can be mounted at high level leaving space below for cranes and other plant.

Advantages:

- When installing radiant heating panels, height is not generally an issue.
- The required temperature in a large space can be varied from area to area without installing any partitions.
- Energy efficient.
- Virtually maintenance-free.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Storage rooms

Situation:

In larger storage rooms, heating is generally only required for the people working there and in some instances heat build-up under the roof space through convection from warm air heating systems can be detrimental to the products being stored.

The solution lies in radiant heating panels:

- To provide heating for staff, but not the air mass.
- To heat the whole area uniformly – by installing radiant panels between racks.
- To suppress the inflow of cold at unloading/loading places – by installing radiant panels above the unloading/loading area.

Advantages:

- The required temperature in a large space can be varied from area to area without installing any partitions.
- A uniform temperature throughout the whole height of the premises (temperature-uniform climate; hot air does not accumulate under the ceiling).
- Radiant heating panels can be moved if the layout of the racks changes.
- Energy efficient
- Low load on the roof structure – the panel is very light.
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.



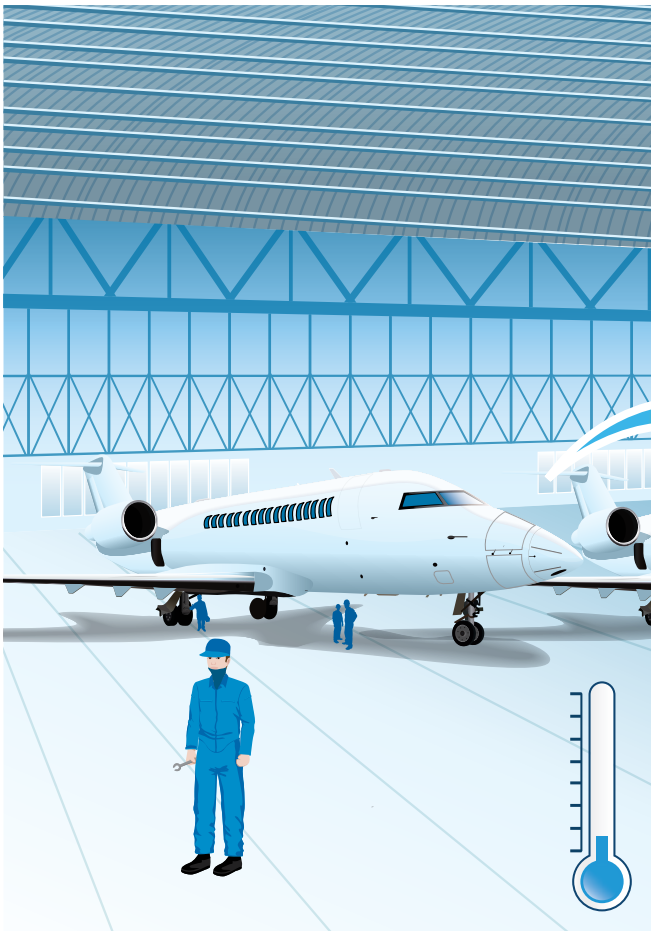
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Large-volume rooms

Situation:

An aircraft hangar requires a lot of daylight – it is a large single volume room with lots of glass walls. In high, spacious rooms, cold spreads quickly and cools the hangar. A constant heat temperature is not required for the whole aircraft hangar, while maintaining the required uniform temperature level in the working area using an air heating system is almost impossible. The adjustment of air heating heat flows is inert – long-lasting; also, high energy costs are required to push warm supply air to the working area from a great height. The hangar staff, who must wear uniforms, are always cold at their working place and need additional warm clothing, which hinders their movements and work, making the working environment uncomfortable, while a layer of useless hot air forms under the hangar ceiling.

The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- To suppress the inflow of cold into the room – to suspend radiant panels along external walls.
- To heat the whole room uniformly – to suspend radiant panels under the ceiling to enable the maximum use of the rooms, e.g. manoeuvring large-sized equipment.

Advantages:

- The height of the ceiling does not influence the temperature at the working place.
- Temperature in required places/areas of the room can be adjusted without installing any partitions.
- The radiant heating panels can be moved if the layout of the room changes.
- Simple and easy control.
- Energy efficient
- Quick installation.
- Noise-free.
- Dust-free.
- Possible option of summer cooling.





Sports spaces

Situation:

Gyms/sports arenas are massive, high-volume and open space buildings. In such buildings, heating is usually required only during events. Due to the volume of such buildings the heating of the occupied area needs to be started many hours before the event. Sporting participants often require a cool area whilst the spectators require a comfortable ambient temperature. However, if an air heating system is installed, it is very difficult to maintain the required temperature in the spectator area only whilst thermal convection causes warm air to rise to the roof space.

The solution lies in radiant heating panels:

- To heat required objects, items, people, but not the air mass.
- To heat a particular area – by installing radiant panels above spectator stands.

Advantages:

- Radiant heating panels provide heating for spectators whilst maintaining a lower temperature in the events arena.
- Only the required areas are heated saving on costs
- Quick installation
- Low load on the roof structure – the panel is very light.
- Simple and easy control.
- Energy efficient
- Virtually maintenance-free.



Good Thinking

At Lindab, good thinking is a philosophy that guides us in everything we do. We have made it our mission to create a healthy indoor climate – and to simplify the construction of sustainable buildings. We do that by designing innovative products and solutions that are easy to use, as well as offering efficient availability and logistics. We are also working on ways to reduce our impact on our environment and climate. We do that by developing methods to produce our solutions using a minimum of energy and natural resources, and by reducing negative effects on the environment. We use steel in our products. It's one of few materials that can be recycled an infinite number of times without losing any of its properties. That means less carbon emissions in nature and less energy wasted.

We simplify construction