

Benefits of Underfloor Heating for Large Spaces

Historically, in New Zealand it has not been common practice to provide space heating for industrial buildings such as workshops, warehouses, production facilities and similar.

In Europe and America, it is a different case with these types of buildings often being constructed with some form of space heating (underfloor, radiant ceiling panels etc.). As we begin to understand more about the benefits of providing a comfortable working environment for staff and customers, business operators are thinking more about their options around providing heating in these large spaces. Some research in this area has suggested that improved comfort levels in these types of spaces can increase employee retention as well as increasing productivity by up to 25%, while also resulting in reduced staff absence.

The Chartered Institute of Building Services Engineers (CIBSE) have some recommendations for the ideal space temperatures in industrial environments, as the occupants are often completing manual labour, much lower temperatures are required than in offices spaces. The recommended temperature range is between 13-16°C however an unconditioned industrial space in New Zealand will fall well below this in the winter months.

In an industrial building with little or no insulation, attempting to heat the entire volume of air in the space is not practical or affordable, so often businesses look to spot heating solutions to deliver comfort where it is needed. Diesel or gas fired, direct radiant or fan forced heating are a good option to deliver spot heating for a relatively low capital cost, however these solutions are inherently inefficient and often require the discharge of combustion products into the space requiring adequate ventilation which only increases the heating load of the space. The high running costs and health implications often leaving building operators wondering what other options they have.

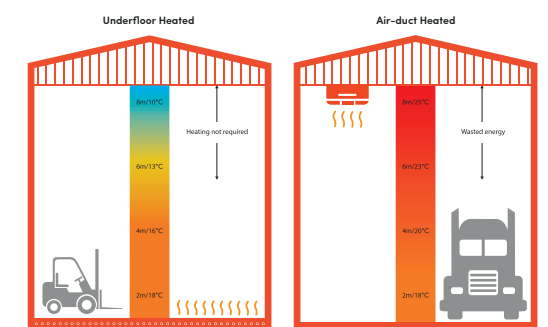


Figure 1

Radiant underfloor heating is ideal for these types of spaces, as it allows a temperature profile of warmth at the floor level and cooler air temperature as the height above the floor increases (see figure 1). This provides

increased occupant comfort and reduced air circulation/ draughts while reducing the energy required to heat the space. While these systems can have a substantial initial investment compared to other options, this will be paid off in the long run through lower energy bills (up to 30% cost savings) while achieving much higher levels of comfort and increasing staff morale.

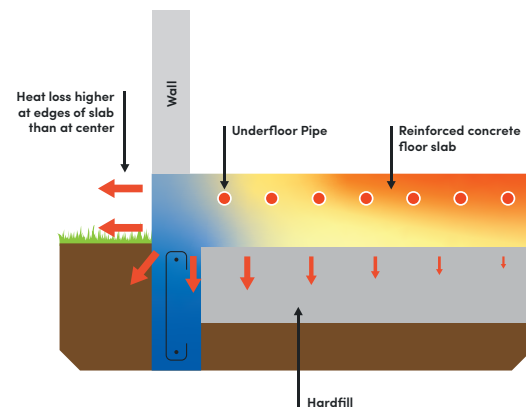
The human body experiences comfort by managing heat loss to the environment around it, one of the main influences of comfort is the radiant component, meaning when we are in the presence of cold surfaces it is hard to achieve comfort via the heating of air only. Underfloor heating provides the advantage of heating both the air and the surface of the floor, the result is that the occupants feel much more comfortable at lower air temperatures making this an ideal solution for spaces with large volumes of air.

Underfloor heating systems require very little wall space, only needing a few locations for manifolds, this frees up walls and ceilings for practical uses, and with the underfloor system hidden in the construction slab it requires very little maintenance with a life expectancy in excess of 50 years making this a long term investment.

Underfloor pipes are typically spaced at 200-300mm centres in these projects, often a defined grid throughout the space is left free of pipe to allow for planned and future fixing of racking, machinery, and similar, this is easily coordinated at the design stage of a project.

Typically, an industrial slab will not have an insulation layer due to the structural load requirements, while it may be perceived that this results in high heat loss actually that is not necessarily the case, a heated slab loses most of its heat out through the slab edge and underside of the first 1-2m from the edge (see figure 2). The insulation value of a slab is based on its area to perimeter ratio, if for example we have a 20m x 50m floor slab without insulation, the area to perimeter ratio is $7.14\text{m}^2/\text{m}$, the construction R value for this slab is around $3.0\text{m}^2\text{K}/\text{W}$ which is well above the specified minimum

for domestic dwellings with underfloor heating which is $1.9\text{m}^2\text{K}/\text{W}$. We recommend if any slab insulation is to be included for large slabs, that this is added to the perimeter and underneath the first 1-2m from the edge, this will have the biggest impact on reducing the heat loss of the building and underfloor heating system through the floor slab. The only exception to this recommendation would be in areas where the water table is high, if the underside of the slab is within 2m of the level of the groundwater full under slab insulation should be considered.



— Figure 2

One of the main advantages of using underfloor for the heating of industrial spaces is the flexible energy source options. Underfloor heating needs only 35-50°C supply water temperatures meaning that these systems can be powered with anything from air to water or ground source heat pumps through to waste heat from process equipment in the building. This results in the ability for the system to be tailored to suit the lowest energy source option and budget requirements available to the project.

Central Heating New Zealand has been involved in dozens of these industrial underfloor heating projects, our team of experienced hydronic heating engineers can work with you to develop an efficient and cost effective solution to suit your project requirements, please feel free to contact us for an obligation free proposal or if you have any questions.