THE BIG CHILL

As the mercury rises, so too will demand for cooling systems

As the effects of global warming become more apparent in the UK, with temperatures in the summer months reaching uncomfortable levels, air conditioning and radiant cooling systems are increasingly in demand. It is therefore a subject that plumbing and heating engineers are likely to asked about in the coming months and years.

High velocity systems

Although air conditioning systems are more common in commercial buildings in the UK, demand in residential buildings is expected to grow in the coming years.

According to Unico, small duct high velocity (SDHV) systems are more likely to be considered as an alternative to conventional air conditioning systems.

"Air conditioning considerations have become so much more than simply keeping a room cool," says Richard Soper, Unico Systems Representative. "Solutions such as SDHV technology offer a more holistic approach by offering heating, ventilation and air purification options alongside the air conditioning mode whilst also removing more humidity than a traditional air conditioning system. The added advantage of SDHV is the fact that the system can be used during the colder months for heating, too."

SDHV systems deliver jets of air-conditioned air through room outlets, eliminating drafts and cold/hot spots in living spaces, resulting in minimal temperature variation. The flexible ducting has been designed with air handlers that isolate noise and vibration.

The air is distributed through small, flexible ducts that can fit almost anywhere in wall or ceiling cavities, between floors and around joists to make them suitable for installation in both new-build and renovated older residential or commercial

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properties. Conventional air conditioning systems are unsuitable for many of these types of application.

SDHV technology can also provide heating, ventilation, air filtration or purification options that eradicate the need for costly and disruptive installation of separate systems.

"Designed for use with air and ground source heat pumps, the Unico System dispenses with the need for fossil fuel energy sources and traditional radiators," explains Soper. "Room outlets fit seamlessly into the ceiling, wall or floor and by getting rid of radiators and pipework, available wall space can be maximised. The design of its cooling coil means the Unico System removes up to 30% more humidity than conventional air conditioning and heating systems.

"There can be a bit of a fear factor with unfamiliar technology among some installers who are used to conventional heating and air conditioning and that is fully understandable. Taking away that fear is a fundamental aim of training programmes, whether in the field of SDHV technology, heat pumps, renewables or any less familiar HVAC product."

Direct expansion systems

There are two main types of air conditioning systems – ones that distribute cooled water, typically 6°C, using chillers in larger buildings, and the second type is direct expansion systems (DX) that offer

Unico air circulation system hidden in the loft.

heating. According to Graham Wright, chair of the HEVAC Air Conditioning Group, demand for expansion systems has been steadily increasing, particularly for commercial applications, such as hotels, shops and offices.

"The domestic market has the potential to grow as our climate warms and building regulations acknowledge this with the publication of Part O (over heating in buildings) and the increasing use of heat pumps both air to water and DX," says Wright.

Installers need to hold a Cat 1 or 2 F-gas Certificate and have the training to enable them to install DX systems. The pipework is different (albeit Copper pipework) as it uses higher pressures (30-40 Bar) and installers need experience in brazing and how to start up these systems. For the smaller systems used in the domestic market, the installation process is straightforward and is a good place to start any journey into this sector of the market.

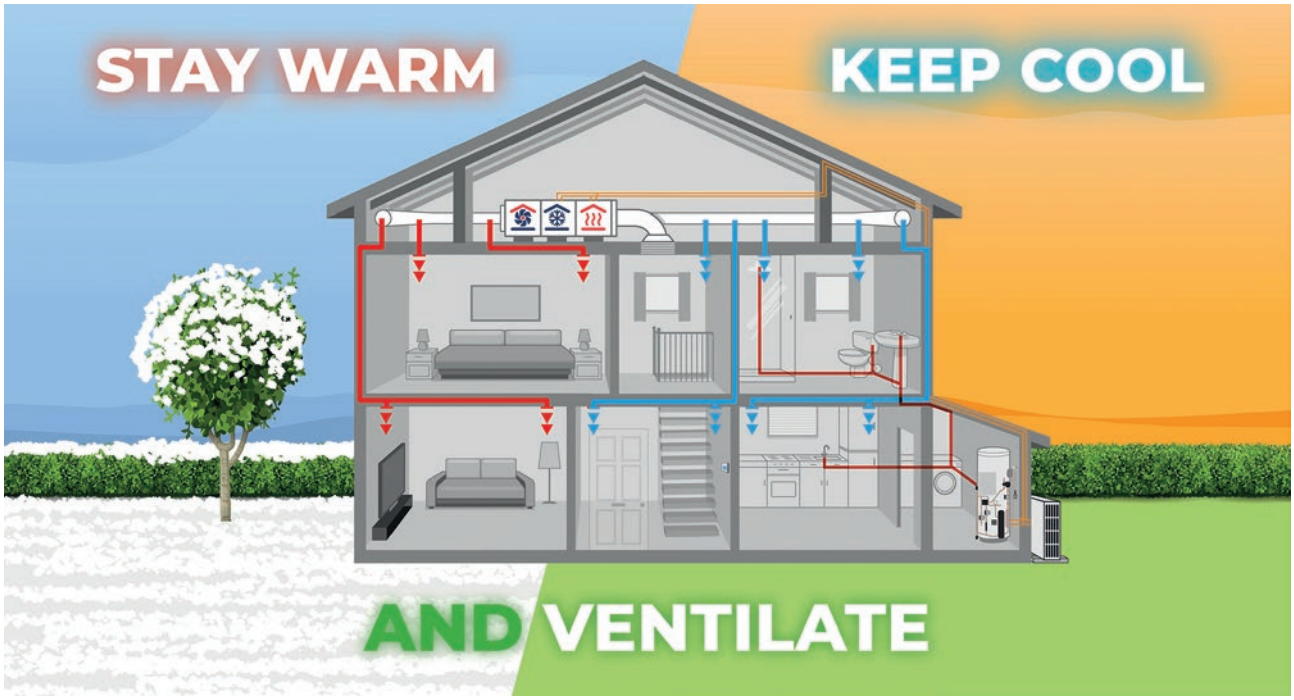
"Installing DX type systems can look straightforward, but there are significant differences between boilers and this type of system, so training is essential," adds Wright. "The market is expected to grow so it is worth looking at this type of work for the future. More complex chilled water and DX systems do need specific training."

Radiant cooling systems

Another alternative to traditional air-conditioning is radiant cooling, which uses cooled water, circulated through water pipes embedded in a building's structure, to evenly absorb heat energy from a room, eliminating drafts and hot spots.

Unlike traditional air conditioning systems, that can contribute to poor air quality by distributing airborne contaminants, radiant cooling systems (RCS) can improve air quality, making them ideal for hospitals and nursing homes.

RCS use the same technology as radiant heating and achieve the best results when



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combined with other energy efficient systems, such as heat pumps.

Radiant cooling technology, using cold water inside pipes, follows the same basic principle as radiant heating. However, it can be installed in floors, walls, or ceilings.

According to Uponor, the low operating water temperatures make this type of system the most energy-efficient method of heat distribution in buildings and therefore more cost effective. They also create better thermal comfort for the room's occupants and provide greater freedom to architects and contractors due to the reduced need for ducts. Ceiling heating and cooling systems can also be combined with renewable energy sources to create more sustainable and energy-efficient buildings.

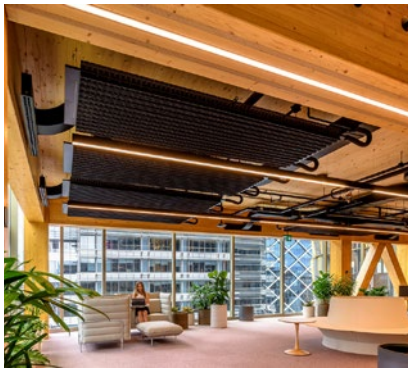
Due to lower system temperatures in their heating modes, radiant systems are perfectly suitable for renewable energy sources. This allows the primary energy consumption and the CO_2 emissions of buildings to be reduced significantly.

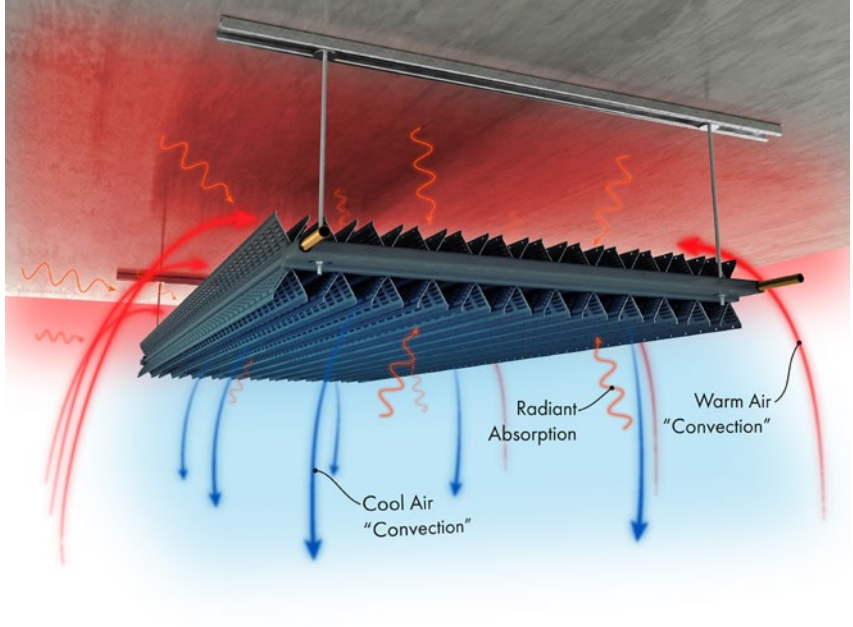
Thermal Active Building Systems (TABS)

These systems use the thermal mass of a building's concrete structure to transport heating and cooling water via pipes. Ceilings, floors and walls are used for cooling and contribute to the heating of the building, too. The inserted pipes utilise the concrete mass to store and exchange thermal energy.

The main difference between TABS and radiant cooling is that TABS use pipes which are embedded within the concrete of the building's structure, resulting in a silent source of cooling or heating.

Uponor TABS, for example, are designed to handle the basic cooling or heating loads of the buildings, in order to maintain a constantly comfortable indoor climate. This method of heating and cooling creates a significantly improved indoor environment improving occupants' health and work productivity.





According to Uponor, the system can operate in tandem with both mechanical and/or natural ventilation systems and is perfect for use with renewable energy sources making it ideally suited for modern, sustainable buildings.

In addition to improved indoor air quality, the advantages of TABS also include low maintenance and lifetime costs, financial savings during the construction phase, 30% more cost effficency in the life cycle of a building compared to conventional HVAC systems, and it's a sustainable approach to heating and cooling.

Uponor TABS can work in conjunction with a free-hanging radiant panels cooling and heating system for quicker response in dynamic cooling and heating loads. Thermal sockets can be installed in the slab in order to enable cooling/heating and/or peak load elements to be suspended directly from the concrete ceiling. The system has an automatic locking device, which means that additional suspended elements can be connected at a later point without having to drain the system first.

(TABS are radiant heating and cooling systems and therefore do not replace ventilation systems.)

Radiant passive chilled beam systems

These suspended cooling panels (or beams), such as the X-Wing® from Frenger Systems, provide cooling by both convection and radiation. The radiant proportion creates no air movement, the only air movement comes from the convective proportion.

As cold water passes through the chilled beam, the warm room air is cooled against the beam's cooler surfaces. This cooled air, which is heavier due to its higher density, then streams through the punched louvres in the radiant wings and percolates through the small ceiling perforations into the room space below (when concealed). In this way, air is circulated within the room, with warm air from the room being continually replaced by cooled air.

> **"At end of life, X-Wing can be separated without specialist processes"**

In addition to this convective cooling process, the cold surfaces of the beam (the radiant wings) also absorb heat radiation from the building occupants and the warmer surrounding surfaces. X-Wing's radiant quotient is approximately 40% of the total cooling effect (the other 60% of cooling being generated by the convective cooling effect previously described). The ability of X-Wing to cool by radiation means that, when compared to a finned tube battery, X-Wing can deliver 40% more cooling without any additional risk of draft.

The efficiency of the convection process, coupled with the ability of the product to exchange energy by way of long-wave radiation, means that X-Wing retains a high cooling effect even when the air temperature in the room is relatively low (e.g. at night or when the building is unoccupied). In this way, large amounts of cold energy can be stored in the building structure during low load periods, and used to offset heat gains when the need arises.

"Our hybrid radiant cooling product, X-Wing, has had demand grow due to it being manufactured from only copper and aluminium," explains Andrew J. Gaskell, technical director at Frenger Systems. "At end of life it can be 100% separated without the need for specialist processes – the aluminium fins are mechanically stitched to the outside of the coil, which can be pulled apart to ensure 100% recyclability of the materials. In addition to this, the product can be installed fully exposed without the need for ceilings, which can further reduce the building's embodied carbon.

"The X-Wing radiant cooling solution works on elevated water temperatures to function above the spatial dew point (dry coil), so can be used with free-cooling chillers or heat pumps to provide energy efficient cooling."

The fact that the X-Wing has no moving parts means it is low maintenance and has a working life expectancy of more than 25 years, subject to water quality being maintained to suit copper.

"Due to the X-Wing's radiant transfer, when installed with an exposed concrete soffit, it can provide direct cooling to the building's thermal mass, which helps keep the building temperatures lower during the peak gains around midday," adds Gaskell. "Some consultants have used thermal modelling with X-Wing / exposed mass to provide low-carbon buildings."

As a greater focus on indoor air quality and temperature increases in the UK, it's important that installers keep abreast of the latest cooling technology. In addition, investing in their professional development in this area will enable them to future-proof their businesses.

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