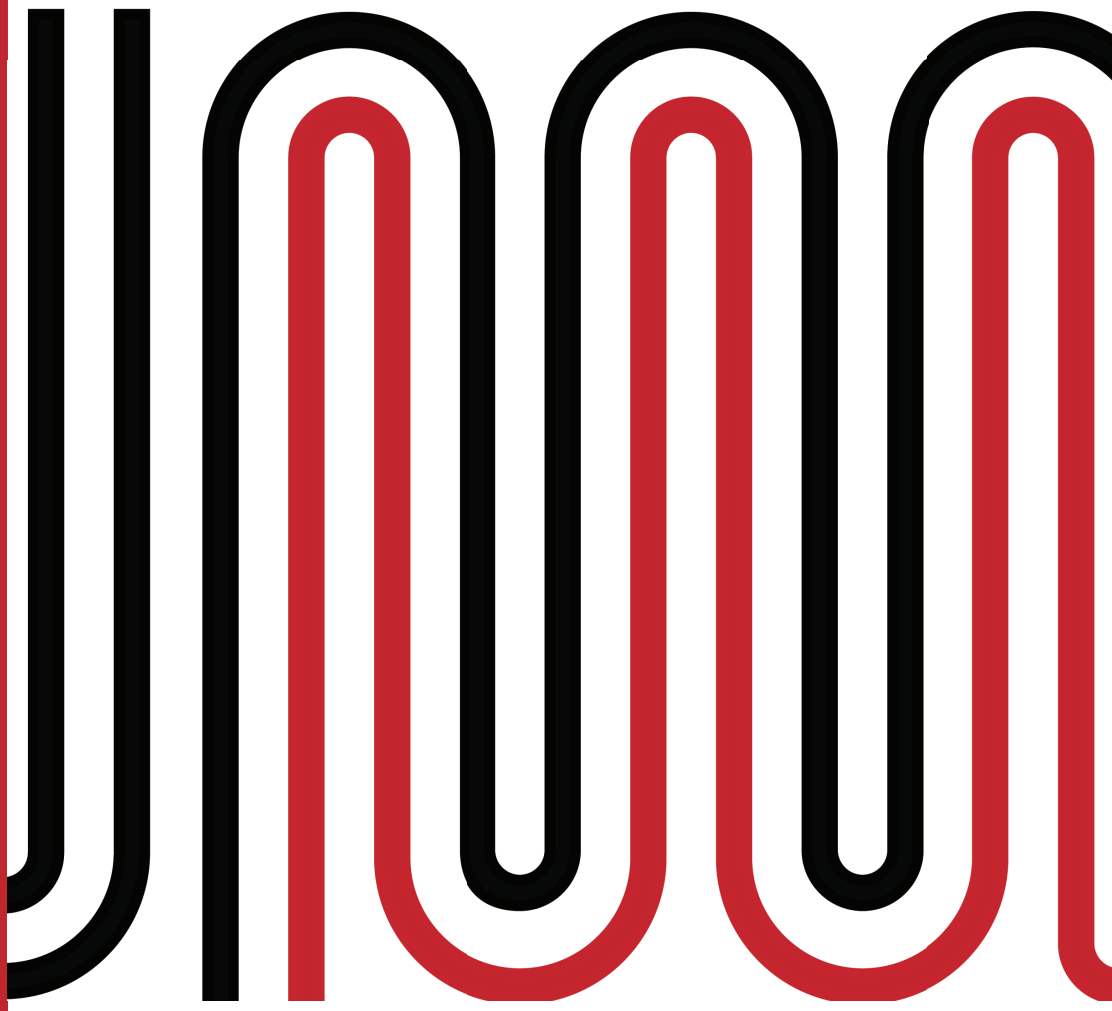
UFH? THAT'S COOL

Can you really use UFH systems to help meet part O of the building regulations?



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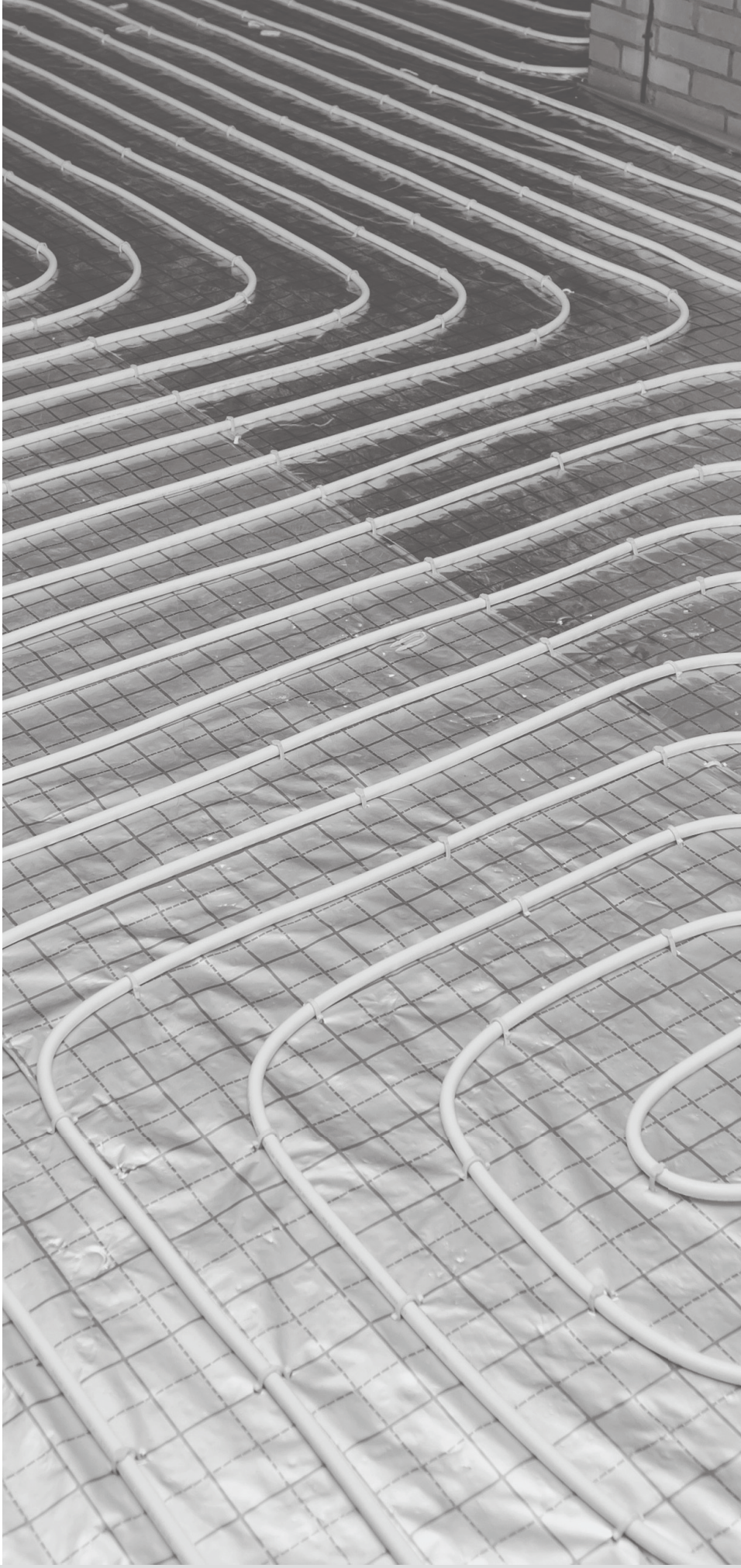

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Combined with a ground or air source heat pump, an underfloor heating (UFH) system can be used in summer to draw heat out of indoor spaces. This offers an alternative way of mitigating overheating in homes where windows cannot be left open at night – for reasons of noise or security. Here we explore the potential of UFH systems to help designers and developers meet the requirements of part O of the building regulations.

With summers becoming hotter, homes are at increasing risk of overheating. Part O of the building regulations – which took effect in England from June 2022 – defines requirements for mitigating overheating in new residential buildings. Ideally, this is achieved by limiting unwanted solar gain in summer while removing heat through natural ventilation. The aim is to protect the health and welfare of occupants rather than to guarantee their comfort.

The part O approved document offers detailed guidance on maximum glazing areas and minimum ventilation opening areas. These minimum and maximum areas vary according to the location and orientation of the building as well as the availability of cross-ventilation. When designers and developers are able to follow this guidance, they can use a simplified method to demonstrate compliance.

However, it is not always realistic to expect occupiers to keep their windows open at night. For example, section 3.2 of the approved document states:

"In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am)."

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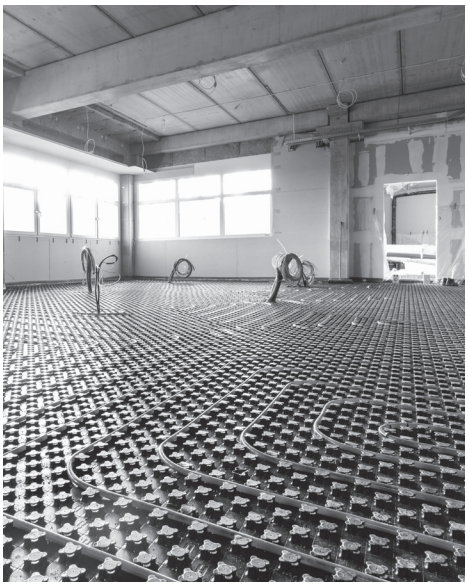

"It should be demonstrated to the building control body that all practicable passive means of limiting unwanted solar gains and removing excess heat have been used first before adopting mechanical cooling. Any mechanical cooling (air-conditioning) is expected to be used only where requirement O1 cannot be met using openings."

And section 3.6 states:

"When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation."

Where windows cannot be left open at night, alternative means of removing heat need to be provided. In these cases, the developer will need to use dynamic thermal modelling to demonstrate that the overall overheating mitigation is equivalent to that offered by the suggested approach. The building regulations require mitigation methods to be passive whenever possible, with section 2.11 of the approved document stating:

THIS IS WHERE UFH SYSTEMS POTENTIALLY HAVE A ROLE TO PLAY.

Offering comfort, interior design versatility and ease of maintenance, UFH is the system of choice for higher-end residential properties. Social landlords, too, are increasingly specifying UFH systems because they are economical to run; their large radiant surfaces provide comfortable heating with much lower flow temperatures than a traditional radiator-based system would need. This characteristic means a UFH system is the perfect partner for an air source or a ground source heat pump. And – when used with a heat pump – a UFH system run in reverse also offers an energy-efficient means of heat removal.

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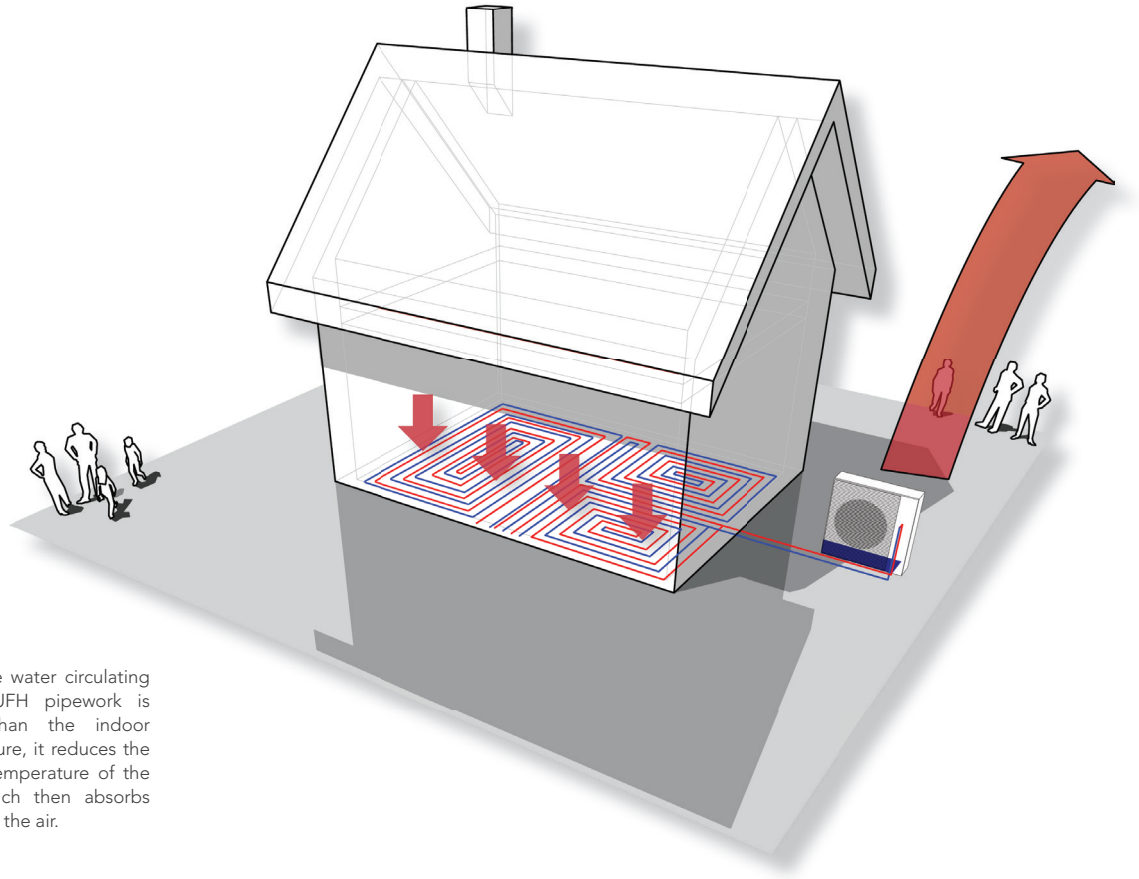

Fig 1

When the water circulating in the UFH pipework is cooler than the indoor temperature, it reduces the surface temperature of the floor, which then absorbs heat from the air.

surface temperature of the floor, which then absorbs heat from the air, as illustrated in **Fig 1.** (The large radiant surface of the floor means that the flow temperature does not need to be much cooler than the ambient temperature of the space.) The heat is drawn into the water in the UFH pipework and carried away to be released into the ground or the air.

With a ground-source heat pump, this process is passive. This is because the below-ground temperature in summer is cooler than the ambient indoor air temperature. Therefore, when its circulation pump is running, the UFH system can collect heat from the dwelling and deposit it directly in the ground. There is no need for the heat pump's compressor to be running.

When a UFH system is used with an air source heat pump, both the compressor and the circulation pump need to be running to achieve the required flow temperatures for cooling. Therefore – while significantly more energy-efficient than traditional air conditioning – this is not a completely passive strategy.

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Every dwelling is different, and the ability of a UFH system to remove enough heat to comply with part O would need to be demonstrated through a dynamic thermal model. However, to give an idea of the level of passive (or near passive) cooling a UFH system can provide, let's consider a two-bedroom flat in central London with a net area of 69.4sq m.

Here, we designed the UFH system to work in partnership with an air source heat pump. The system included two manifolds, the pipework was spaced at 100mm centres and the floor finishes were a mixture of tiles, engineered timber and carpet. We calculated that, with a flow temperature of 18°C, the UFH system could provide a total of 1.28kW of cooling.

Used in this simple way for overheating mitigation, a UFH system requires no additional or special components apart from a control system that is designed for cooling as well as heating. Therefore, we believe this could be a simple, elegant and cost-effective method of meeting the requirements of part O in new homes where windows cannot be left open at night.

We are continuing to gather evidence to support this approach, and we would love to hear from you if you have considered or are considering using a UFH system in this way.

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