uponor

Heating and cooling

SOLUTIONS FOR INDUSTRIAL AND RETAIL BUILDINGS

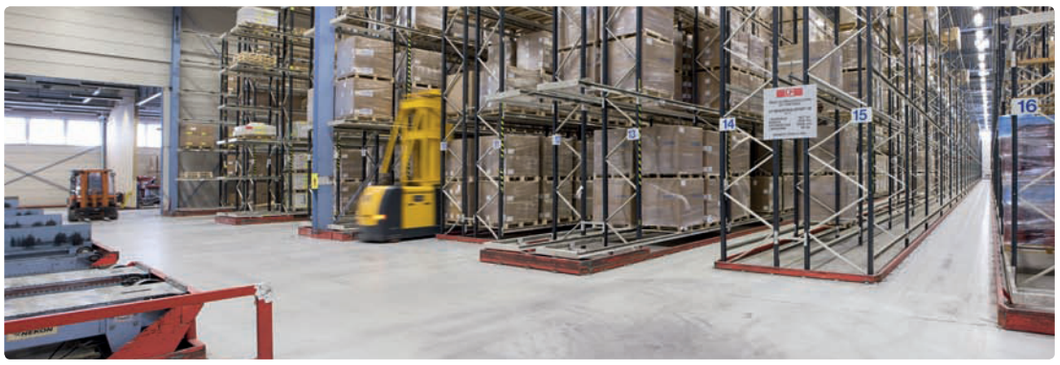
Choose Uponor for an enhanced environment

Our dialogue with customers has resulted in continuously developing the way we deliver services to construction projects. As a leading provider of indoor climate and plumbing solutions, we aim to bring new ideas into practice and generate better services for every partner in the process, all the way from investors to installers.

Our support in all stages of construction – right from the very first concepts to buildings in use – contributes to the quality of the built environment and the efficiency of the construction process.

The sustainability of buildings is becoming more and more important to both society and our industry as a whole. Our solutions provide the best basis for indoor comfort combined with the most efficient use of energy. It is at the core of what we do. This is why we partner with professionals to create a better environment in every meaning of the word.

"Our approach to create innovative solutions that bring efficiency and sustainability"



Uponor service and support

1 Feasibility
2 Develop Solutions
3 Design & Engineer
4 Installation / Contract Management
5 Test Commission & Handover
6 Aftersales Support

As a key part of Uponor's offering to the UK market, the a division provides a complete design, supply and installation service for indoor climate solutions. Focussing upon larger scale commercial projects, our team can provide comprehensive support from building design through to aftersales...

The additional value of Uponor expertise

Our solutions are made to provide superior quality, easy integration into the building process and to give higher value to the building.

As leading experts in water based radiant systems, Uponor offers a superior thermal environment for working at optimised energy efficiency and cost.

Our low energy solutions are ideal for the use of renewable sources and help reduce consumption and CO2 emissions.

We provide the construction industry with safe, fast and efficient installation technologies, giving long-lasting, healthy and trouble-free solutions. We allow developers to improve the solutions quality standards, offering differentiation and added value to their buildings.

Our large ranges of products, which are corrosion resistant, hygienic, completely feasible and flexible, are designed as systems that integrate the construction process.

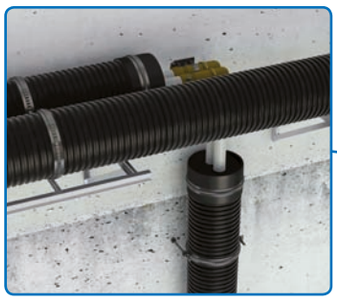
Our systems are designed to offer long life and no expensive maintenance.

Our technical service guarantees local support in all process stages, from design to installation.

Uponor is always at your side to support you in the design stage.

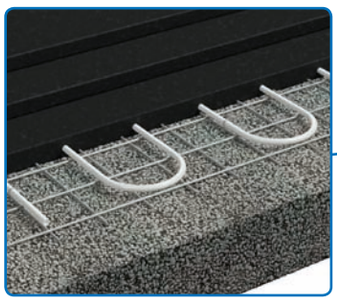
- Low investment cost
- Low running cost
- Freedom of design
- Proven technology
- Optimal working environment

Uponor systems for industrial and retail buildings

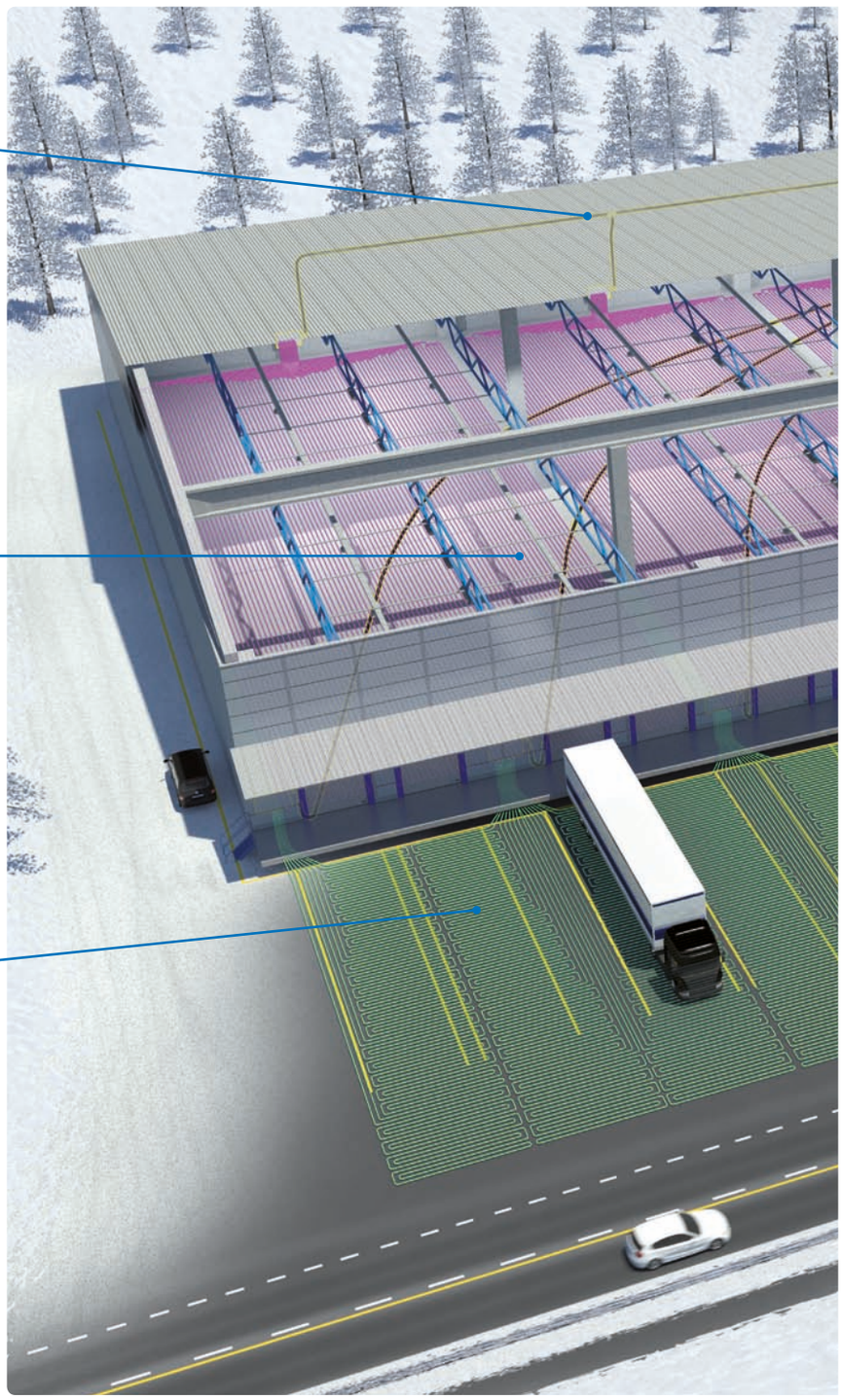


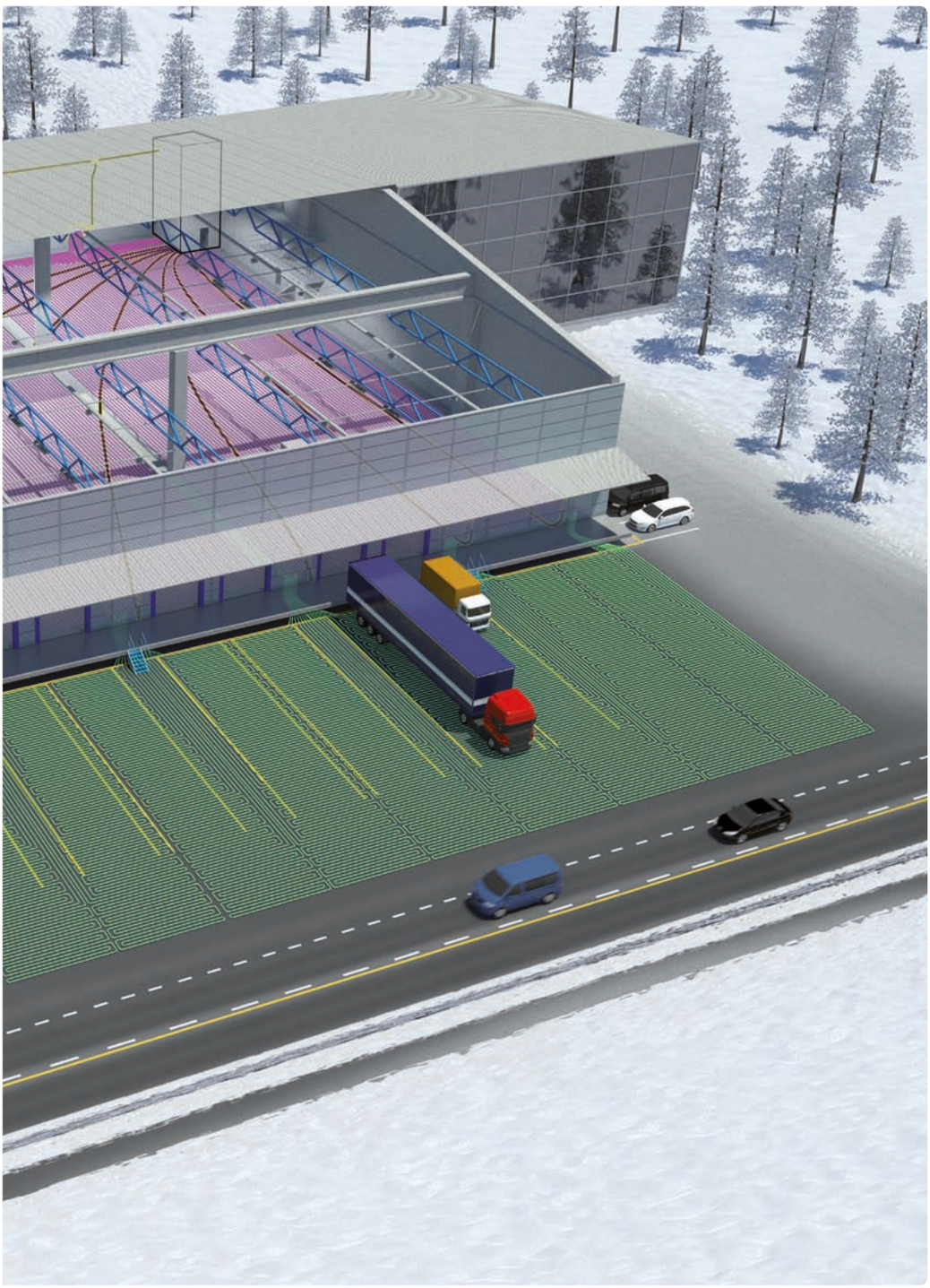
Uponor pre-insulated distribution pipe system

Uponor Industrial floor heating & cooling system



Uponor Snow and ice melting system





Uponor does not only offer you high performance through high pipe technology but radiant heating and cooling systems for the industrial building.

Our caring starts with manufacturing the reliable, robust and durable PE-Xa pipe that is able to cope with the tough environment of floor construction in an industrial building. We design and optimise the Underfloor heating system to our customers' specific needs and ensure that our system is delivered on time. It is installed by Uponor trained installers and we provide support and reliable partners for total project delivery.

Uponor industrial floor heating and cooling system

Low maintenance

Hall space is too cost-sensitive to surrender valuable space to a heating system. Conventional, visible heating surfaces incorporating pipework,ducting, and fans must be regularly cleaned, replaced, painted, and maintained, quite the opposite of what the Uponor Industrial Underfloor heating system can offer. The Uponor underfloor heating system does not require any effort in terms of individual maintenance. In this way we can reduce the operating costs dramatically, leading to a quick return on investment.

Cost efficient

The Uponor industrial underfloor heating system is cost efficient because the entire system can be operated at low temperature levels. Heat losses at the point of heat generation and distribution can be minimised. Ground energy and the possibility to use existing thermal energy, e. g. from production processes, can additionally decrease energy expenses. Through whole floor construction optimisation the effectiveness of the energy source can be fully utilised.

Field of Application

Uponor Industrial Underfloor heating and cooling system is a low-temperature heat distribution system to heat or to cool industrial spaces.

The construction and composition of industrial floors strongly depends on the effects of static and dynamic loads. These can be wheel loads of vehicles, static loads of shelves and machines, but also the mechanical and chemical impact on floor surfaces have to be considered.

The great advantage of the Uponor Industrial Underfloor heating system is that it does not influence the static calculation. Because of this the system can be built directly into the concrete floor slab.

Moreover, there are no more static constraints regarding the roof construction due to the heating system. In other words, the ideal conditions for making optimal use of the interior hall space.

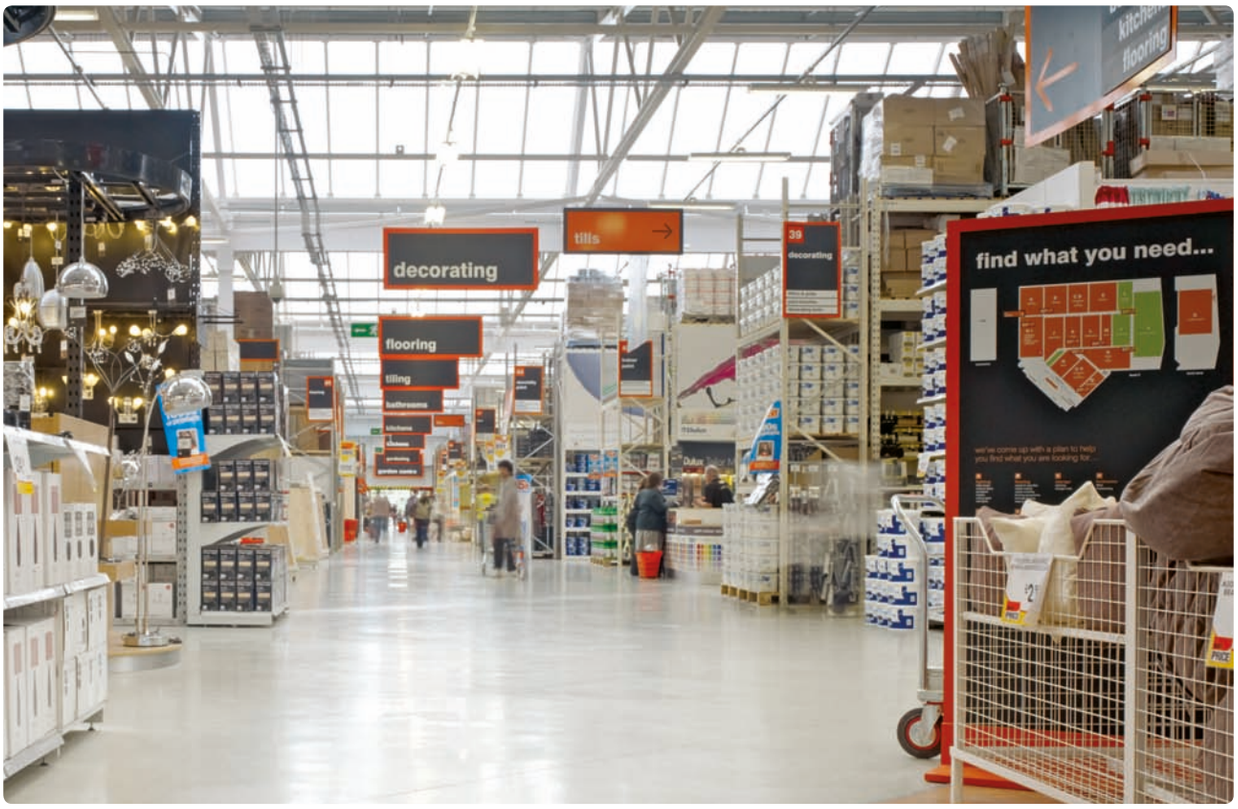
This is a fact that makes our system so flexible and universally applicable.

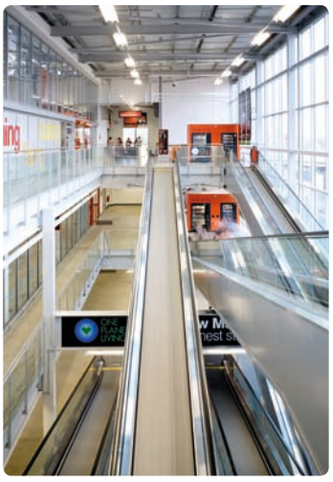
System benefits

- Long life time with low maintenance costs
- Fast pay back time in combination with low temperature heat sources
- Adjustable system with optimal building space utilisation
- Suitable for different kinds of industrial buildings

Smart system for serious use:

Applications range from retail outlets, workshops, through production halls with light and heavy machinery, to warehouses where forklift trucks are used and even airport maintenance hangers.


decorating
tills
flooring
tiling
bathrooms
kitchens
find what you need...



Uponor model

To be able to provide a unique service to the UK construction market Uponor continuously searches and develops a partnership and operation model that will suit the floor contracting done with laser screed machines. Uponor has been able to demonstrate the effectiveness of offering and design and can install the floor heating/cooling system together with concrete flooring companies and within a single works package. This way a floor heating and cooling system can be offered without any compromise to the slab installation program.

Design

The design and installation of ground slabs incorporating a floor heating and cooling system will not compromise the original slab design brief and with a full understanding of the issues surrounding joints, drilling zones etc.. are able to ensure that we are able to offer a competitive and innovative solution from a single source avoiding the traditional conflicts in responsibility.

Load capacity

The Uponor industrial underfl oor heating system is, by its very nature, unaffected by the load exerted by vehicles, since it does not utilise any components that would limit the vehicle load, such as insulation. The Uponor industrial underfloor heating system can be incorporated into practically every type of concrete slab construction, including steel-reinforced concrete, prestressed concrete, vacuum concrete, roller compacted concrete and more. The basic criteria for choosing a construction type are the requirements determining the type of use to which the floor will be subjected. Both point loads from racking and dynamic loads from forklift operations need to be considered here.

Important information for planning:

- Unlimited vehicle load kN/m2
- Dimensioning of concrete slab by structural engineer

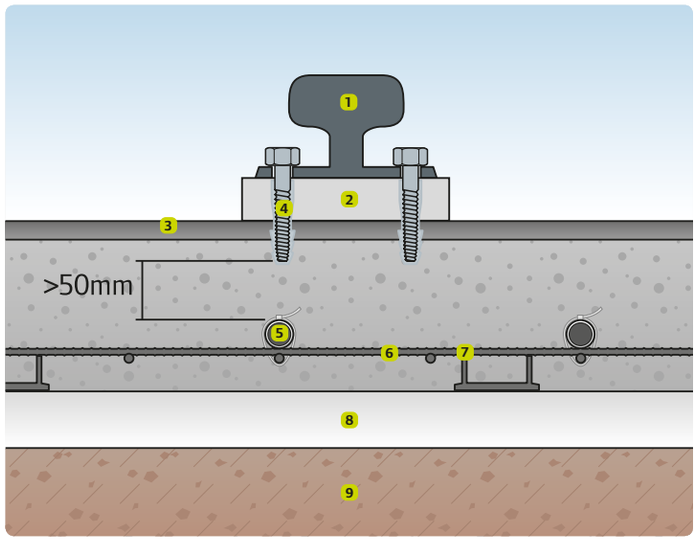
Permitted Total weight [t]	Nominal loadbearing capacity [t]	Static axle load (standard load) P [Mp (kN)]	Average track width a [m]	Total width b [m]	Total length l [m]	Uniformly distributed vehicle loads (standard load) [kp/m2 (kN/m2)]
2.5	0.6	2 (20)	0.8	1	2.4	1000 (10)
3.5	1	3 (30)	0.8	1	2.8	1250 (12.5)
7	2.5	6.5 (65)	1	1.2	3.4	1500 (15)
13	5	12 (120)	1.2	1.5	3.6	2500 (25)

Equipment in the halls

Commercial buildings often have footings for various equipment, for example high rack storage and machine foundations, anchored into the concrete floor. The specialist heating engineer must be fully informed about how deeply these foundations and anchor points penetrate into the concrete slab. Occasionally there may be a risk that they penetrate far enough into the concrete slab to reach the level of the heating pipes. Should this be the case due to the concrete slab being insufficiently thick, then the heating pipes must be left out of this area, creating a so-called blind area.

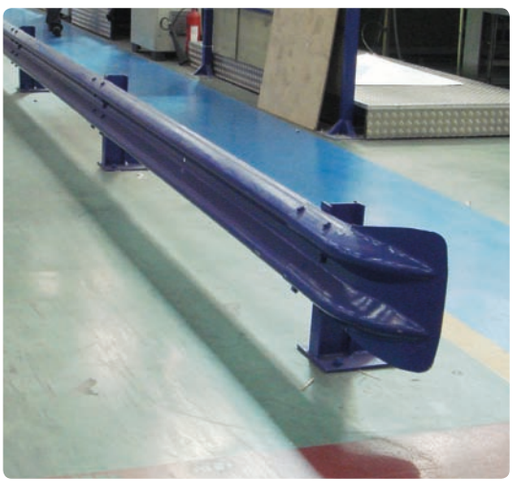
Important information for planning:

- Determine the maximum depth of penetration into the concrete slab of all anchor points and foundations for all equipment to be installed in the building.
- A minimum safety distance of 50 mm from the pipe should be observed.



Penetration depth of equipment

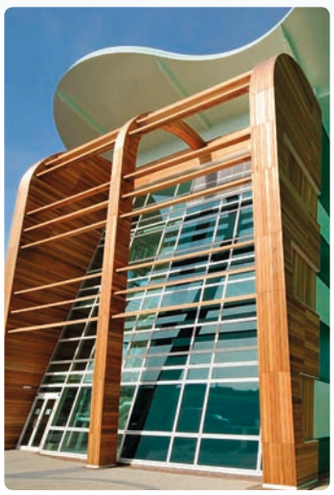
1. Rails for industrial trucks
2. Equalisation base
3. Wearing layer
4. Anchors
5. Uponor PE-Xa pipe
6. Reinforcement
7. Spacer
8. Insulation
9. Ground/gravel



Case study

Chatterley Valley

Blue Planet, Stoke-on-Trent



The pioneering new project called Blue Planet Chatterley Valley was developed by Gazeley UK Ltd and hosts ultra-green sustainability credentials for the 385,000sq ft warehousing facility.

Built by Main Contractor McLaren Construction, the velta one system was incorporated directly into the ground bearing slab in conjunction with a laser screed machine. Working alongside Stuarts Industrial Flooring the pipework was integrated into the slab without causing any time delays.

Daily production of up to 1,800m² of completed floor incorporating the velta one system was achieved.

Single warranty for both floor heating and concrete slab – offering total piece of mind for the client.

The benefits

- The energy efficient system will last the life of the building and provide the following;
- The heat is in the occupied working zone and offers the flexibility to provide high rise racking without the obstruction of fans or ductwork.
- No requirement to clean or maintain the system, a marked contrast to visible heating systems which require a separate maintenance expense.
- The system is installed at the time of installing the concrete floor with a Laser Screed Machine, providing super flat floors with great programme savings and single warranty.

"The scheme was to build one of the world's greenest business and logistics parks in North Staffordshire."

Project Team

Client	Gazeley UK Ltd
Main Contractor	McLaren Construction
M&E Consultant	KTA
M&E Contractor	C A Sothers
StructuralEngineers	Capita Symonds

Uponor velta & Stuarts Design Considerations

Area of project	33000m^2
Required heating output	39W/m^2
Boarder zone in front of dock levellers	68W/m^2
Slab Thickness	225mm
Slab loading capabilities	UDL of 50kN/m^2, Racking Load 100kN
Total number of pour days	18
Specialist Info	Laser screed finish

Case study

B&Q Superstore

New Malden - London

The concept for this store was to demonstrate the store design and construction of the future, utilising renewable energy sources.

The systems used within the building and the construction methods also had to adopt this philosophy and demonstrate environmental benefits.

Uponor Velta heating and cooling system was incorporated into the retail floor area extending to 9,000 m².

The system was installed in the composite structural floor consisting of precast concrete units and structural concrete topping. The installation was undertaken with the concrete flooring programme, causing no delays and the system set to allow a bolt drilling zone for floor fixings.

Single warranty for both floor heating and concrete slab – offering total piece of mind for the client.

The benefits

- The energy efficient system will last the life of the building
- Energy efficient heating and cooling through the use of renewable energy
- Low maintenance
- Flexibility for future store layout and ideal comfort at occupied level
- Fast installation and single warranty for floor and system

Project Team

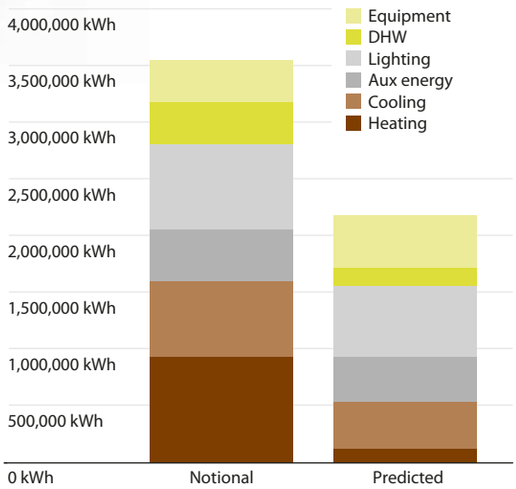
Client	B&Q Retail
Architect	Black Architecture
Main Contractor	Simons Construction
M&E Consultant	McBains Cooper
M&E Contractor	L J Monks
Structural Engineers	Bradbrook Consulting

Uponor velta & Stuarts Design Considerations

Area of project	9000m²
Required heating output	60W/m²
Slab Thickness	125mm
Slab loading capabilities	UDL of 35kN/m², Racking Leg Load 50kN
Total number of pour days	9
Specialist Info	Flood poured structural topping to pre-cast concrete beams

"B&Q flagship store in New Malden, London will benefit from having 10% of its energy needs catered for by renewable energy sources on site."

Energy consumption



Source: BSD Building Sustainable Design LOWENERGY SOLUTIONS FOR ENGINEERS AUGUST 2009 | £8 | VOL 1 N0 7, Features article building analysis retail squeeze.

System	Rooftop warm-air AHU	Geothermal with suspender water to air heat pumps Geo heat pump	Geothermal with suspender water to water heat pumps and underfloor system Geo heat pump
Heating	Gas fired	Geo heat pump	Geo heat pump
Cooling	DX		
Electricity	Grid	Geo heat pump grid	Geo heat pump Geo heat pump
Annual energy cost	£192,000	£168,000	£158,000
Scheme capital cost	£270,000	£414,000	£577,000
Affected structure capital cost	£107,000	£57,000	£205,000
25-year energy cost	£2,689,000	£2,357,000	£2,220,000
25-year lifecycle/replacement cost	£401,000	£344,000	£240,000
25-year planned preventive maintenance	£989,000	£989,000	£329,000
25-year TOTAL	£4,445,000	£4,161,000	£3,571,000
Simple payback based on year 1 costs		3.99	12.13
Savings compared with base system (based on 25-year total)		£294,000	£884,000

Renewable energy analysis (based on 2006 prices) comparing standard B&Q system of heat pumps suspended from ceiling against underfloor heating and cooling

Case study

Beckton Waterfront Development

This project involved the construction of industrial and office units as part of the London Olympics relocation plan. As part of the Olympic Development Agency's remit, the project delivers 10% renewable energy.

The integration of a Uponor one industrial heating and cooling system cast directly into the floor slabs and fed from a closed loop ground source heat pump to provide low temperature heating and cooling was an attraction. The site received a BREEAM assessment rating of 'very good' for its carbon friendly initiatives. The project was a world first to incorporate a floor heating system directly into a structural high tolerance concrete floor slab laid with laser screed techniques.

The benefits

The velta system was incorporated into two units totalling 15,000m^2.

- Linked with GSHP for heating and cooling capability
- Reduced construction costs with single slab construction
- Low life maintenance costs
- Fast construction – 1200m^2 of system and concrete floor produced each day.
- Single warranty for floor and system

"The project was a world first to incorporate a floor heating system directly into a structural high tolerance concrete floor slab laid with laser screed techniques."

Project Team	
Main Contractor	McLaren Construction
M&E Consultant	Building Services Design
M&E Contractor	Walter Miles
Concrete Flooring Contractor	Stuarts Industrial Flooring

velta system installed	
Area of project	15,000 m²

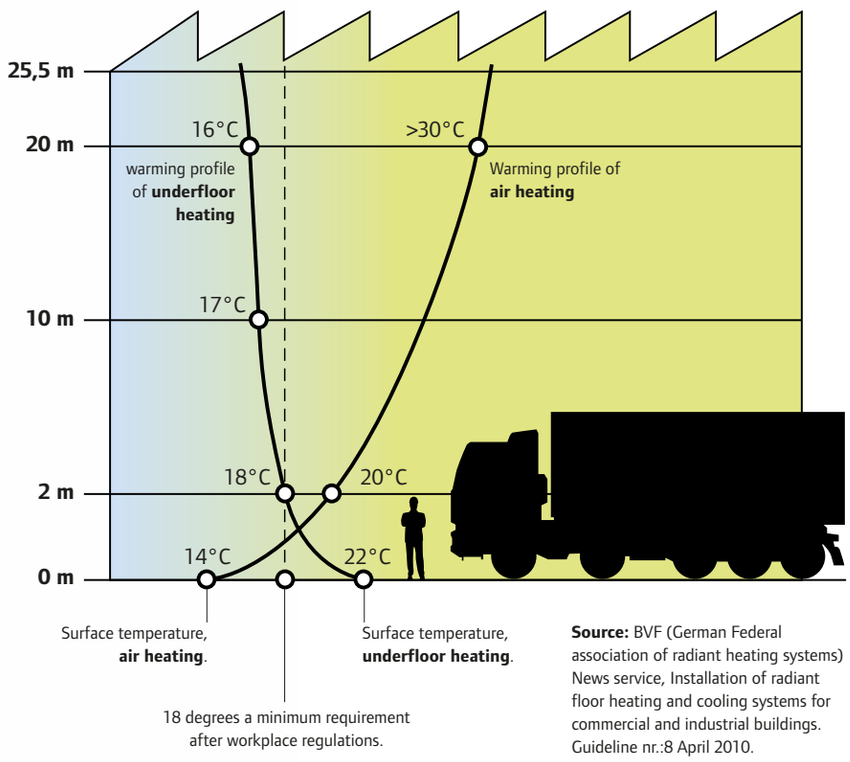
Efficient and safe working environment

Every machine has an optimal operating temperature but what about people? A pleasant temperature in the workplace motivates staff to perform at their best. In general, the temperature of the floor plays an important role, alongside the room air temperature. The Uponor industrial underfloor heating system creates this ideal working atmosphere. It provides a large area with heat radiation without dust circulation. This makes it ideal for warehouses, storages and retail outlets where you want to keep your items and products clean.

System benefits

- No noise - silent system
- Constant and even temperature level
- Low air speeds with no dust circulation
- Efficient and safe working environment

Temperature curve of an industrial underfloor heating and ceiling-mounted air heating system:



Source: BVF (German Federal association of radiant heating systems) News service, Installation of radiant floor heating and cooling systems for commercial and industrial buildings. Guideline nr.:8 April 2010.

Uponor Snow and ice melting system

Better working environment

To offer more answers on how to create efficient and safe working environments we must not forget that the outdoor areas outside the industrial building are as important as indoor comfort. Uponor has a long tradition in developing different snow and ice melting systems and have used this experience in providing safe pedestrian paths, parking areas and loading areas for trucks. This has prevented accidents and created an efficient and safe working environment all year round.

Low Maintenance

One of the most changeable and unpredictable costs that is an existing but still changing factor is snowfall. It will happen every year but no one knows exactly when and how much snow there will be. This creates constant problems with the cumbersome manual removal of snowfall. Sometimes you have enough machinery to do it but sometimes it can cause delays that last days. This problem can be drastically eliminated with the Uponor snow and ice melting system. No more will snow piles interfere with decorations, furnishings and normal commercial activity. This benefit can be easily calculated in decreased manual snow removal maintenance costs and transferred to constant unchangeable surface heating costs that are easily predictable.

"Benefits can be easily calculated in snow removal costs."

Reducing energy consumption

Because of rising energy prices and climate change, the heating and cooling of your building is a major cost factor. Why pay for oil and gas when all you need is right there on your premises?

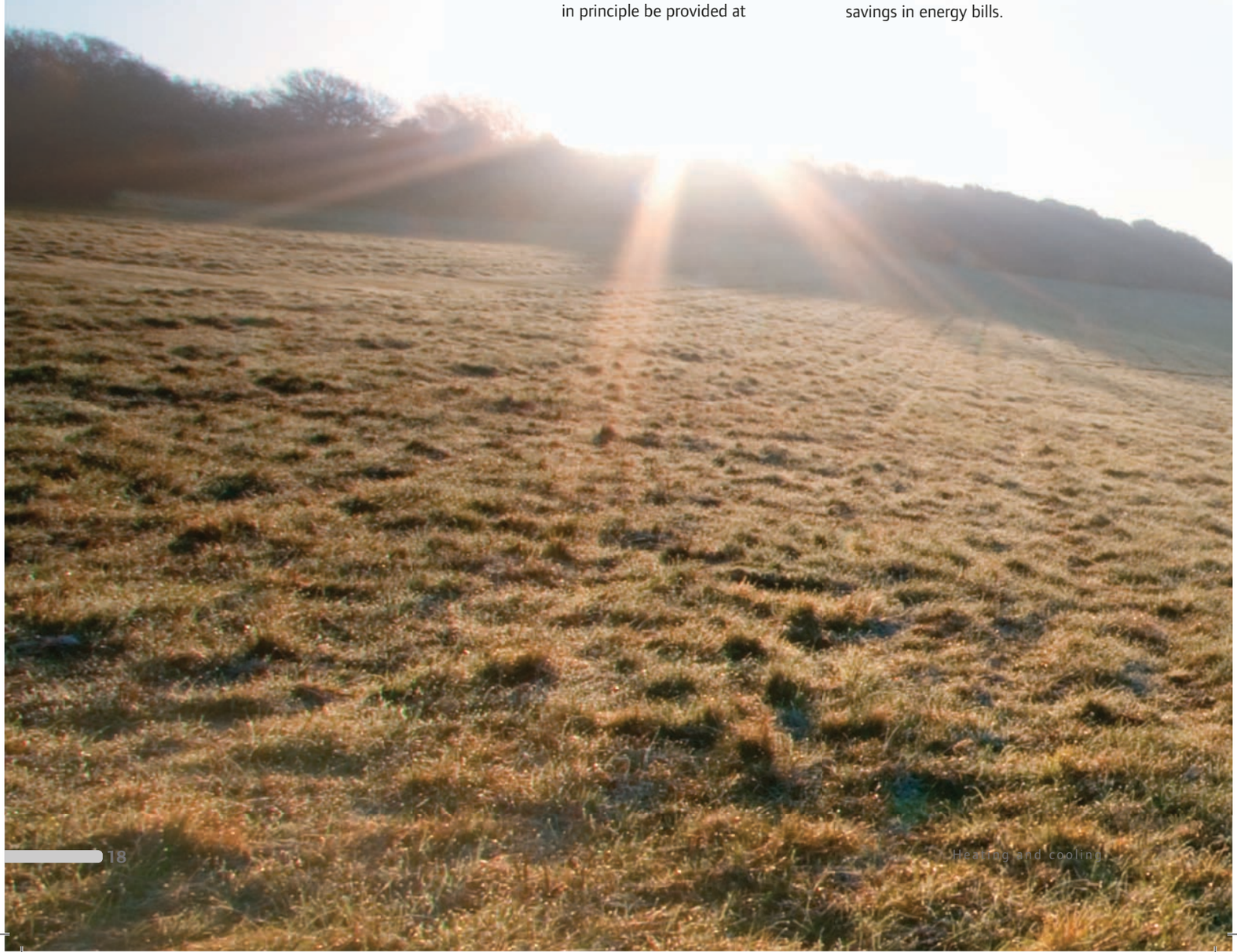
Renewable energy and improved energy-efficiency are key elements for reducing energy consumption and achieving sustainable building design that is ready for the future.

Low temperature heating and high-temperature cooling are the key to integration of renewable energy sources into high-performance buildings. Using large surfaces as emitters allows heating and cooling at temperatures very close to that of the ambient environment. This means that renewable energy available from the ground, water, sun and air can be integrated and utilized with ease.

Optimizing energy-efficiency by using floor heating

Both heating and cooling can in principle be provided at temperature levels that are close to the desired room temperature. A low temperature difference between the energy source and the desired room temperature requires only that the heat transmission take place over relatively large surfaces, as, for example, is done in floor heating systems.

A heating system designed with floor heating operating at a supply temperature of 40° C instead of air heating with a supply temperature of 80° C will yield significant annual savings in energy bills.



No energy source has lower operating costs than ground-source energy

Ground-source heating can be incorporated into the system via ground heat pumps. With a low-temperature radiant heating system, heat pump performance will significantly increase in comparison to traditional, high temperature systems and air heating, as the efficiency of a heat pump depends on the supply temperature.

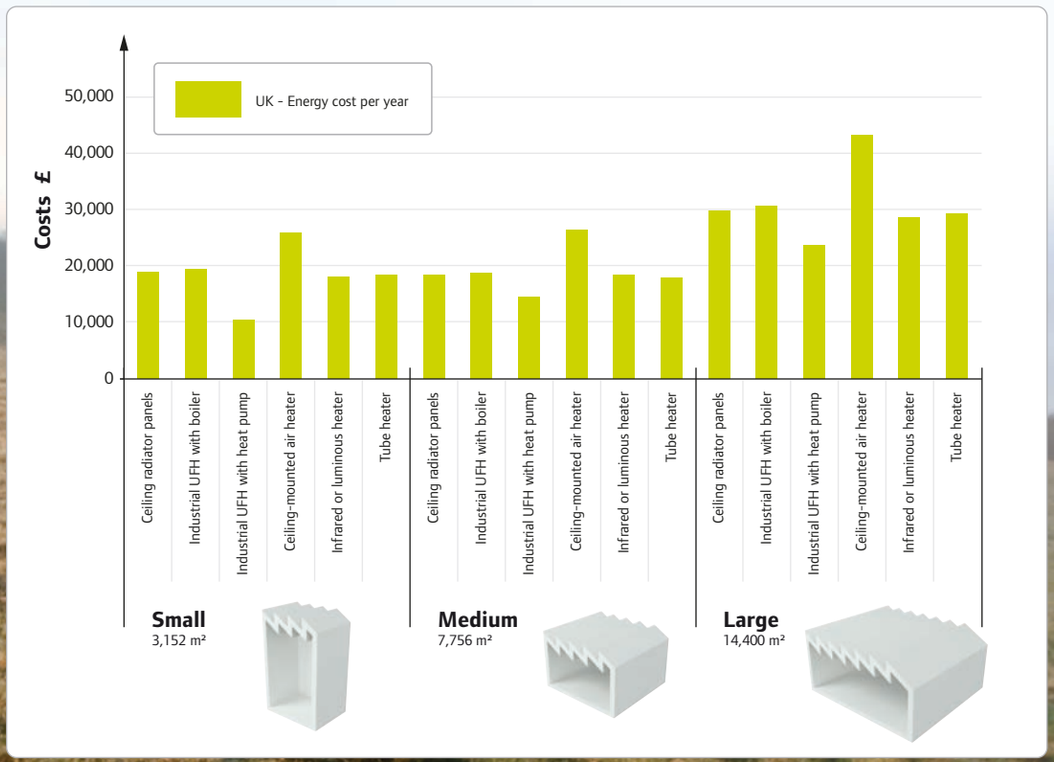
Ground energy has higher installation costs than many other energy sources do. However, because of its low operation and maintenance costs, it is important to compare the lifetime costs of different energy sources before a choice is made.

Combining a radiant cooling system with a free cooling source can reduce energy consumption by 80 - 90%, since traditional chillers can be eliminated and only electricity for circulation pumps is needed.

Natural-ground water has ideal temperature levels for radiant cooling systems. Alternatively, the systems can be operated with sea-water cooling or solar cooling that uses absorption chillers.

Heating and cooling with ground energy means:

- Independence from future developments of oil and gas prices
- Reduction of CO_2 emissions
- Infinite energy that can be used at all times, all year round
- Low operation costs, through professional planning
- Cooling at almost no cost
- No taxation risk, thanks to its environment-friendly nature



Energy costs are calculated with a National Statistics Publication, Department of Energy & Climate change, Quarterly Energy Prices. Pricing is based on 2011 3rd quarter prices.

Source: Uponor Industrial solutions comparison of industrial heating systems

Service and support

Uponor solutions provide service and support through projects in their entirety, from initial feasibility studies to engineering and installation continuing through to test commissioning and aftersales. By offering this level of support we ensure that every solution is unique and perfectly designed for the application.

"Focussing upon larger scale commercial projects, we can provide comprehensive support from building design through to aftersales."

1 Feasibility

Working closely with our clients and their chosen design team from an early stage allows us to provide a consultancy service which determines the most appropriate solution for their specific building. With our innovative systems we are able to bring new proposals to many projects and provide prospective clients with the opportunity to submit alternative bids.

2 Develop Solutions

We offer in-depth modelling to determine whether a system would meet the client's needs and we use computer assisted engineering software to determine a project's viability for a specific type of system. Uponor systems have been designed to allow installation into most modern forms of construction – precast, prestressed, post tensioned, cast in situ, screed and wall systems.

3 Design & Engineer

We turn development ideas into technical development by collecting and analysing data from the design team responsible for the project. Nominated Uponor Design Engineers, experienced in your particular application, are designated to the project. The latest Uponor software is used to design your project to the most current European Standards.

4 Installation / Contract Management

Uponor Contracts Managers liaise with the client's project team to discuss the planning, organisation and management of resources to bring about the successful completion of the project. Dialogue with other contractors who interface with our works will be encouraged by the Uponor team to ensure that everyone achieves a successful installation.

5 Test Commission & Handover

Our systems undergo full testing and commissioning, by Uponor engineers, before we hand the system over to the client. velta also offer a full controls installation service, which provides a complete in house package to our clients and sits perfectly with our standard testing and commissioning service.

6 Aftersales Support

We pride ourselves on the post installation support that we provide for all our clients. Each system is unique and Uponor staff are always on hand with help and advice throughout the life of the system. Uponor are able to offer a range of services to assist in post installation activities, such as Thermal Imaging and Hydronic analysis with the latest technology.

Uponor industrial floor heating system

The Uponor Industrial Underfloor Heating System is based on the most commonly known and widely established system solution for industrial buildings. It consists of just a few separate components from manifold segments, installation accessories and Uponor PE-Xa piping.

This makes planning and installing the Uponor Industrial Underfloor Heating System an easy affair. Depending on the heating load, heat source and size of the building to be heated, the length of heating circuits will range between 200 m and 300 m. Using Uponor 90° pipe guidance arcs, each heating circuit is separately connected to the Uponor industrial manifold.

The Design philosophy for the building should be undertaken utilising the high radiant effect associated with floor heating. This philosophy usually leads to a reduction in the internal design temperature, as operative temperature should be utilised and not air temperature. It is common for operative to be up to 2 ºC lower than air temperature and this can lead to energy savings of approximately 12%.

With the floor surface acting as the emitter the heat load demand can be based on the occupied zone which is usually the first 2.5m of space rather than the total height or volume of the building which is often the case for other heating systems. This leads to a reduction in the heat loss for the building and can lead to a reduction in the plant required for the heating and cooling load.

Advantages

- Very few system components
- Simple planning and installation
- Possibility to use the same system for heating and cooling

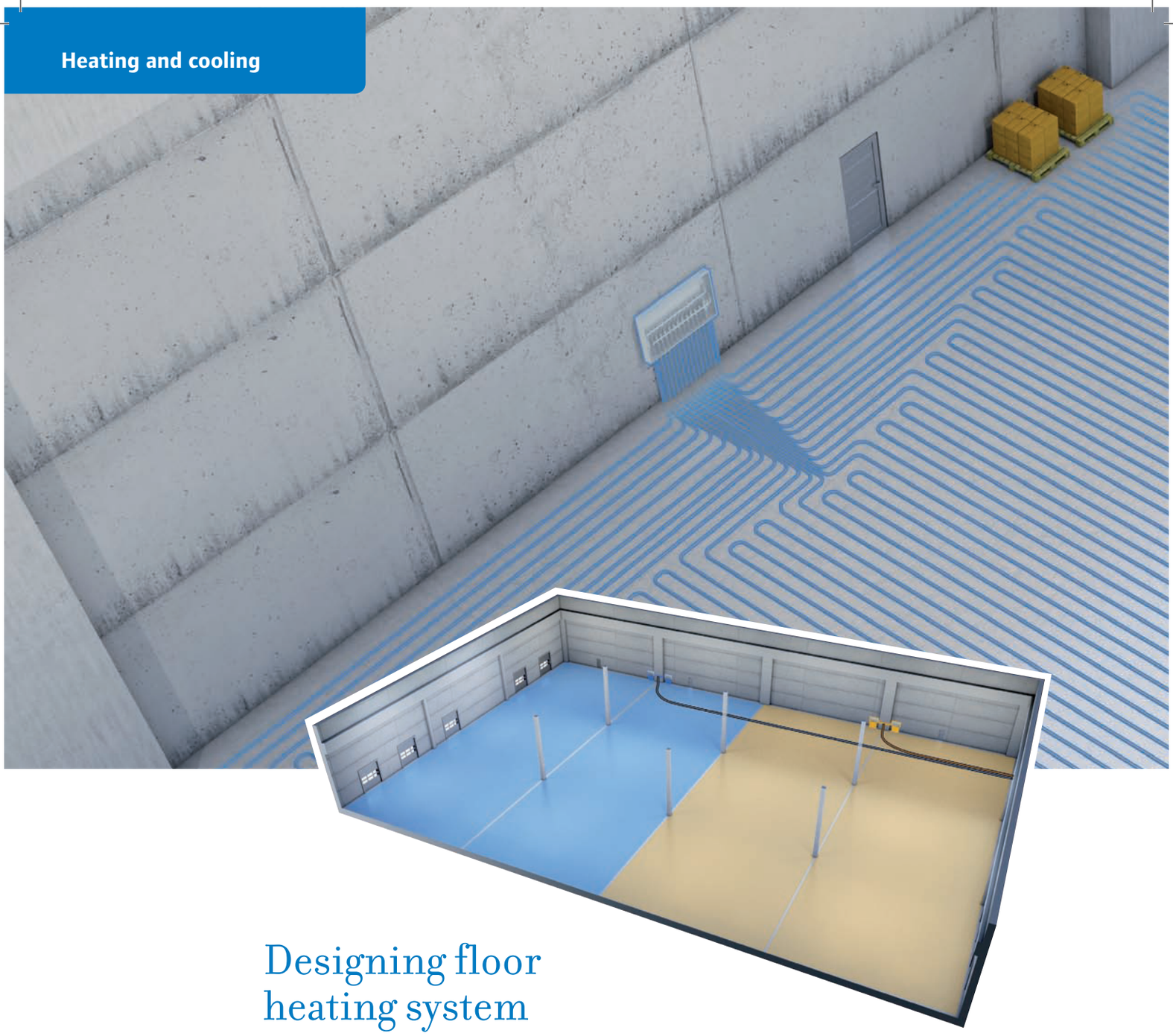
Typical data associated with a system of this nature would be as follows:

Industrial building	**Winter mode**	Internal temperature	16°C
		Heating Output	40-50 W/m²
		Flow water temperature	40°C
		Return Water temperature	25°C
		Av. temp. of the concrete surface	21,5°C
	Summer mode	Internal temperature	26°C
		Heating Output	25 W/m²
		Flow water temperature	16 °C
		Return Water temperature	20 °C
		Av. temp. of the concrete surface	23 °C
Retail building	**Winter mode**	Internal temperature	20°C
		Heating Output	60 W/m²
		Flow water temperature	40°C
		Return Water temperature	30°C
		Av. temp. of the concrete surface	26,5°C
	Summer mode	Internal temperature	26°C
		Heating Output	30 W/m²
		Flow water temperature	16 °C
		Return Water temperature	20 °C
		Av. temp. of the concrete surface	23 °C

"Possibility to use the same system for heating and cooling."

Cooling through the base slab

Increasing numbers of office and management buildings, residential complexes, thermally intensive production facilities and other industrial buildings are using floor cooling. However, the large concrete thicknesses above the pipe only allow for limited cooling loads. For this reason, pipe spacings between 15 cm and 20 cm are required. Given typical design parameters (tV/tR= 16/20°C and ti=26°C), cooling loads of approx. 20 W/m² to 30 W/m² can be achieved.

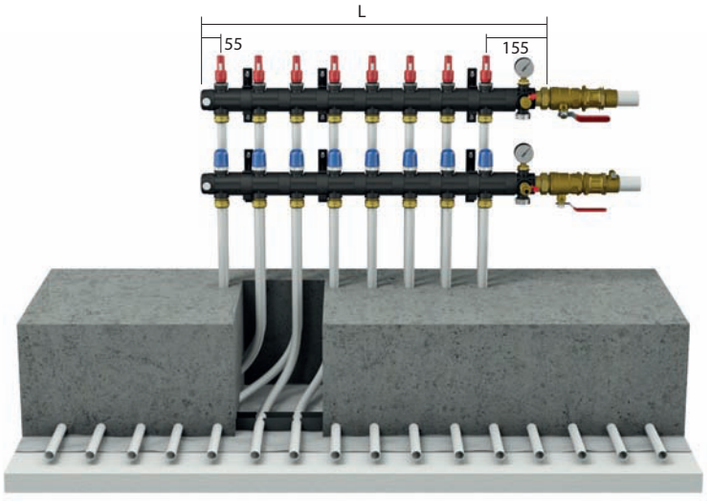


Designing floor heating system

If using a Uponor Industrial floor heating system to heat industrial buildings the piping must be chosen in accordance with the requirements, location and basic design of the building in question. The building can be split into a series of zones and each individual zone controlled to a different condition, allowing for future flexibility for re-design of the building function and layout. The system can be controlled from standard BMS systems.

Uponor industrial manifold

The Uponor Industrial Manifold is an easy and adjustable solution for different sizes of large buildings. It is a modular manifold system created from separate manifold blocks and this makes design, purchase and installation easier and safer. Manifolds can be adjusted either by increasing or decreasing manifold blocks to the existing floor heating manifold even during the construction phase. Depending on the on-site situation, the Uponor Industrial Manifold should be installed before the concrete is placed, either to an existing wall or, if no walls are (as yet) present, to an auxiliary structure constructed



in-situ. The Uponor PE-Xa heating pipes must then be fed out of the heating plane below the manifold using Uponor pipe bend supports and connected to the manifold. The manifold feed pipes can be connected either alternately on the left and right, or to a single side.

Zone control

The manifold can be used to serve dedicated zones. These zones can be controlled individually if required or as a one for the entire building. The control philosophy can be changed at a future date as long as sufficient zoning is designated in the initial design. Each zone can be either in cooling or in heating mode. We suggest that the decision of changeover between heating and cooling is based on the whole building and not individual zones.

Primary pipework

Primary pipework to the manifolds can be treated in a number of ways. Overhead solutions can be considered or the pipework can be embedded under or within the structural slab. Alternatives have also been constructed with the primary pipework running underground external to the building.

Circuits	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
L [mm]	310	410	510	610	710	810	910	1010	1110	1210	1310	1410	1510	1610	1710	1810	1910	2010	2110
Required clamps	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6

Ideal system for the distribution of heating and cooling

Low investment through flexibility

The Uponor local heat distribution pipe is the proven name for the innovative, flexible, pre-insulated plastic piping system, designed to transport a variety of liquids both inside and outside buildings.

Our solution is to offer a pre-insulated distribution pipe system for cooling as well as for heating networks. We offer one single system that functions efficiently in terms of cost and energy.

With Uponor pre-insulated distribution pipes, chilled water for cooling systems can easily and economically be transported to buildings. The network installation can be handled quickly and efficiently on site even in the most difficult conditions.

Its material properties give long service life, and as the pipes are of low-weight and are highly flexible, they can be installed quickly and easily, even over obstacles and round corners.

The Uponor pre-insulated system is the practical, perfect and multifunctional pipe system for industrial heating or cooling needs. It is the ideal system for the distribution of heating and cooling.

System benefits

- One system for heating and cooling network
- Approved and tested complete systems
- Advanced technologies for all system components
- Strong support and service for projects
- Certification and warranty
- Long experience in the production of pre-insulated pipes; over 30 million meters produced since 1985

Connection in supply corridor

Sometimes a supply corridor is provided for gas, water, electricity, and other installations either in the ground below the concrete slab or directly in the concrete itself . If this is the case, then it is also possible to install the Industrial Manifold in this supply corridor. It must, however, be rotated by 180° compared to the standard orientation before fitting to the wall of the supply corridor so that the heating loop connecting pipes lead upwards. The heating pipes must be routed through 90° towards the heating level using Uponor pipe bend supports. Since the industrial manifold may be mounted up to 1m below the heating level, air separators must be included in the design to prevent formation of air bubbles. Stray residual air can also be transported out of the heating level and into the overall network at water speeds of 0.4 m/s and higher.

Connection in a shaft or manifold box in the heating level

Manifolds can be located vertically on walls and concealed in cabinets or they can be placed as a space-saving solution horizontally, which is practically invisible, within the floor slab itself. These horizontal spacings can be a purpose-built shaft or manifold box within the heating level. If used this way the boxes or shafts should be included with appropriate steel covers.

Primary pipe work to the manifolds can be treated in a number of ways. Overhead solutions can be considered or the pipework can be embedded under or within the structural slab. Alternatives have also been constructed with the primary pipework running underground external to the building.

How to cross concrete joints

Structural engineers are responsible for planning joints in the structural concrete floor and the Uponor heating system is not a critical factor due to the low temperature of the water used to heat the floor and the high temperature of the water used to cool the floor.

Standard bay sizes and pour profile proportions apply dependant upon the concrete and the reinforcement utilised. Standard joint profiles such as Alpha type, can be used with the Uponor system and velta request a joint plan in order to coordinate the pipework circuits and the connecting pipework to minimise the crossing of formed joints.

Expansion joints

Joints that allow movement are generally known in the concrete construction trade as expansion joints. These provide continuous separation of the concrete slabs to a distance of approx. 15-20 mm and are filled with a soft jointing material (e.g. foam sheet or fibreboard), which is fixed in place before the concrete is poured.

Expansion joints are not designed to break up the floor, but rather to provide separation from other objects like ducts, conduits, supports and walls.

The underfloor heating system does not affect the planning of the expansion joints but the connecting pipes that cross over expansion joints must be protected against the anticipated mechanical stresses in the area around the joint using protective pipe sleeves of 1m in length. This can be insulation material or a protective pipe for instance.

Construction joints (day joints)

Neighbouring areas of the concrete slabs are connected to each other by construction joints. These are not movement joints, but rather occur simply as a result of adjoining bays being poured at different times. In order to ensure proper transmission of force from one slab to the next, these sections are combined by using tongue and groove joints or creating a positive connection with dowelled joints.

Heating pipes that cross a construction joint must be sheathed for a distance of 1m using protective pipe sleeves or protective pipes in cases where the heating pipe is subject to mechanical stress before pouring the concrete, for example due to the positioning of formwork over the heating pipe. It is advisable to design and install the underfloor heating system in such a way that crossing these joints is avoided.

Dummy joints

Dummy joints are cut into the concrete slab after it is formed and serve as predetermined breaking points. These cuts are approximately 3–4 mm wide and cut to a depth of around 25–30% of the slab thickness. The intentional crack that occurs below the cut has a certain amount of denticulation that allows transverse forces to be transferred from one concrete slab to the next. Dummy joints do not require the use of protective pipe sleeves or protective pipes. Dummy joints can also be of a "closed" type, created by cutting a post-casting groove approximately 25 mm deep, then using a special sealing compound and partially filling with foam rubber.

Expansion joints

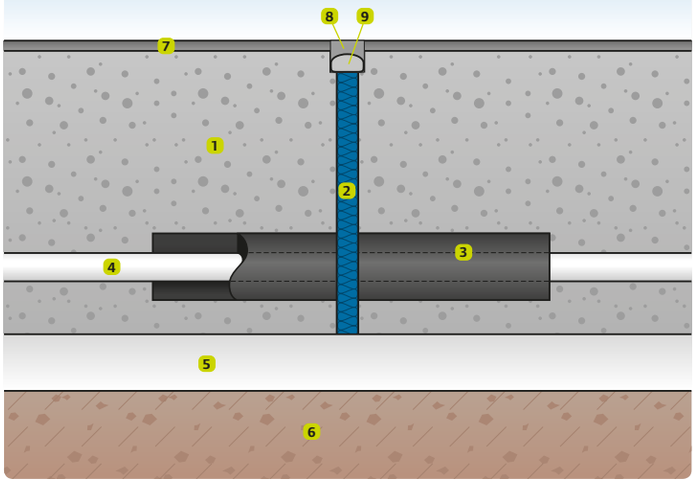


Illustration of an expansion joint

1. Concrete
2. Expansion joint
3. Uponor Protective pipe sleeve
4. Uponor PE-Xa pipe
5. Insulation
6. Ground/gravel
7. Wearing layer
8. Joint sealing compound
9. Foam rubber

Important information for planning:
Expansion joints are not designed to break up the floor, but rather to provide separation from other objects like ducts, conduits, supports and walls.

Construction joints (day joints)

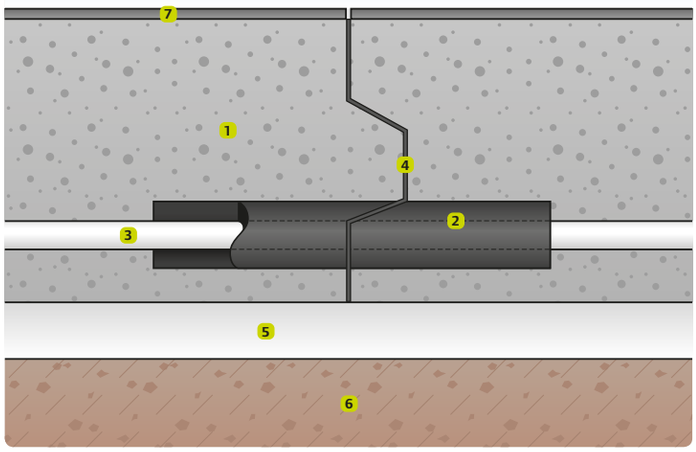


Illustration of a construction joint

1. Concrete
2. Uponor Protective pipe sleeve
3. Uponor PE-Xa pipe
4. Dummy joints
5. Insulation
6. Ground/gravel
7. Wearing layer

Important information for planning:
Heating pipes that are subject to mechanical stress during installation where they cross construction joints must be sheathed with protective pipe sleeves or protective pipes.

Dummy joints

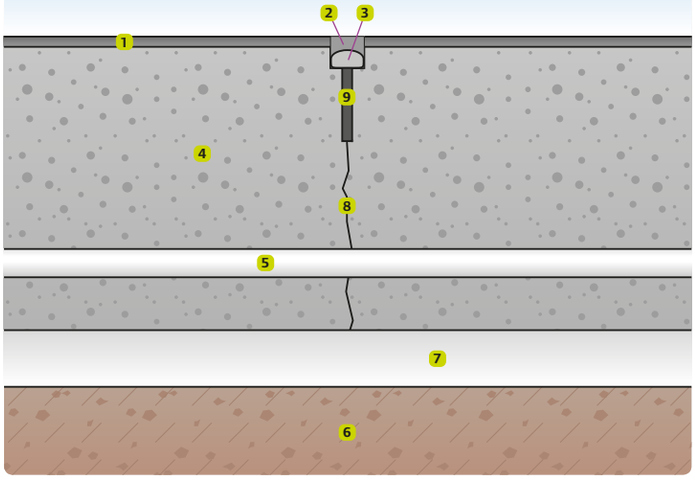


Illustration of a dummy joint

1. Wearing layer
2. Joint sealing compound
3. Foam rubber
4. Concrete
5. Uponor PE-Xa pipe
6. Ground/gravel
7. Insulation
8. Fine crack
9. Dummy joint

Important information for planning:
Find out the joint layout from the structural engineer before preparing designs for an industrial underfloor heating system. Agree the maximum possible depth of cut with the building engineer.

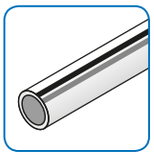
Adjustable system solution for different floor structures.

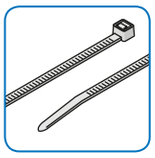
Ground Floor slab construction

The Uponor Velta industrial system can be incorporated into most concrete floor slabs with insignificant modification to the floor slab depth and construction.

Option 1:

Heating lines fastened to reinforcement mesh using Uponor industrial pipe ties.





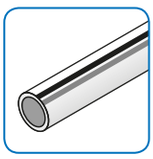
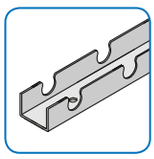
Components:

- Uponor PE-Xa pipe
- Uponor PE-Xa pipe clip

Option 2:

Heating lines fastened using Uponor industrial clamp track type 25.

Important note about designing:
To prevent the Uponor Industrial Underfloor Heating System from buoying upwards, the industrial pipe fastening rails must be tightly anchored to the ground/insulation using appropriate ground pegs.

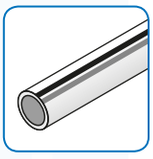
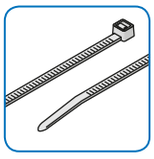




Components:
- Uponor PE-Xa pipe
- Uponor PE-Xa Clamp track
- Uponor Clamp track nail

Option 3:

Heating lines fastened to reinforcement mesh using Uponor industrial cable ties.

Important note about designing:
Insulation has to be calculated according to actual valid country standards. When using Industrial Underfloor Heating system and the floor structure is designed without insulation we recommend to use a humidity barrier underneath the floor structure to prevent soil moisture from raising up from the ground to the floor structure.

Components:
- Uponor PE-Xa pipe
- Uponor Pipe tie

Efficient working environment is

- **Cost effective**
  Minimised running costs due to the ability to use free and low cost energy.

- **Human friendly**
  Optimal working environment with neither dust nor indoor draughts. A pleasant temperature motivates staff to perform at their best.

- **Reliable**
  Safe working environment with products that are proven in use. Being a partner with Uponor will bring benefits – reliably.

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Uponor Heating and cooling 02/2012